Electrical World

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IN Northern Europe one invariably finds that the native engineer gives a large amount of credit to the American engineers for being ultra-practical but takes credit to himself for being theoretical as well and for ability to incorporate the artistic in the commonplace. Take, for example, the outdoor switching station. * * * * He isn't accustomed to observing his transformers and circuit breakers standing in the rain or half covered with snow, and cannot be reconciled to the idea. "It may be all right over there," he will say, "but the climate is too moist over here." Yet, the few examples Europeans have are working wonderfully well.

—From

Power Plant Practice in Northern Europe

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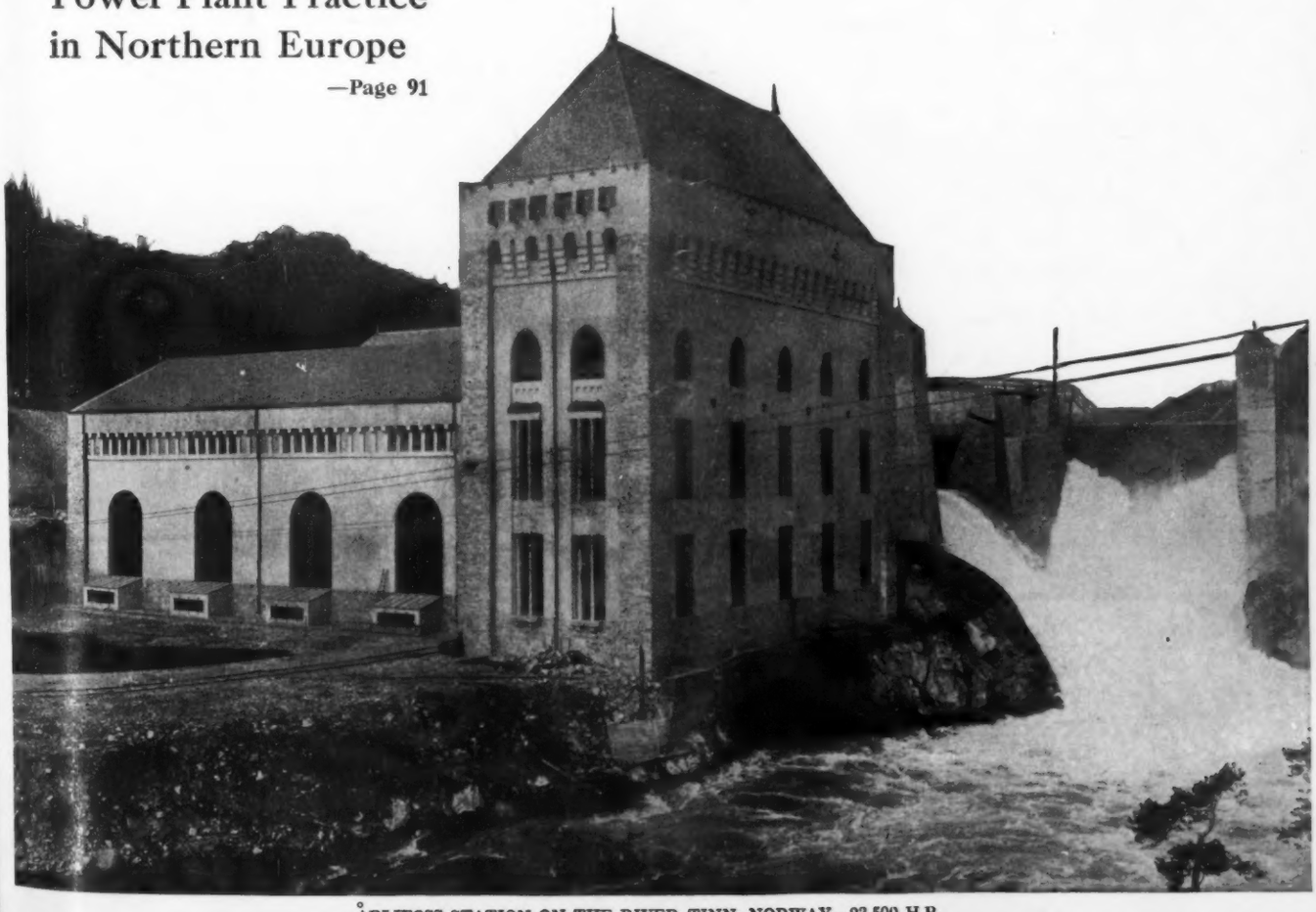
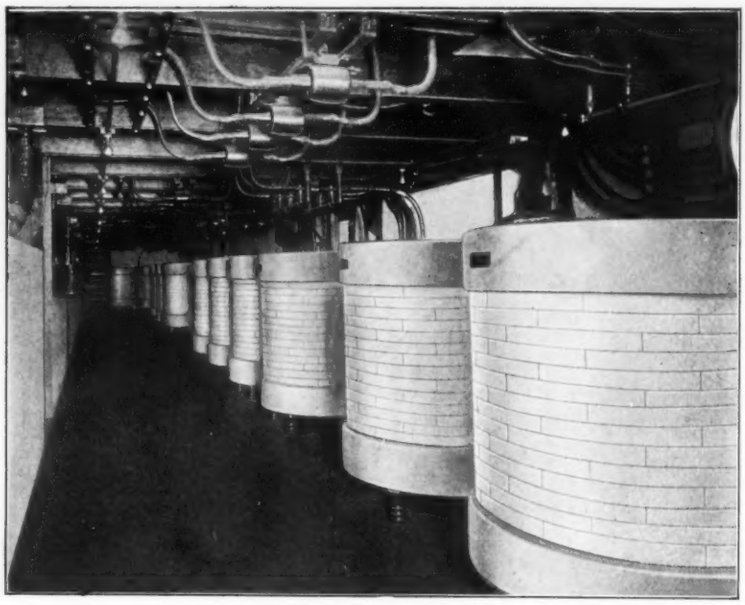
Also in this issue—

Power Factor as It Affects the Consumer
Automatic Substations Success in St. Paul
Keeping Public Contacts from Sparking
Higher Steam Pressures and Temperatures
Electric League Co-operation



ÅRLIFOSS STATION ON THE RIVER TINN, NORWAY—23,500 H.P.



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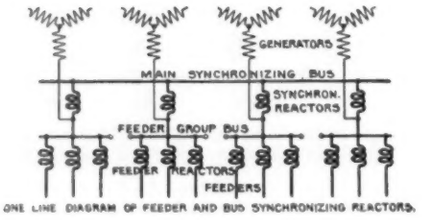

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Electrical World

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W. H. ONKEN, JR. Editor — HAROLD V. BOZELL Editor

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An Achievement in Efficiency by Electric Utilities

CONSERVATION has long been uppermost in the mind of every manager and operator of an electric public utility. While the word has usually been associated with water power, it is equally applicable to steam power.

For years engineers have insisted on and manufacturers have produced apparatus of greater reliability and efficiency. With rising costs of labor, fuel and equipment, it was necessary for utility operators to exert themselves to the utmost if the cost of service to the customer were to be kept down. How well the task has been performed and to what extent coal has been conserved let the government say.

BURIED in the circular on "Production of Electric Power and Consumption of Fuel," issued by the United States Geological Survey on Jan. 4, 1923, is this tribute: "An examination of the table showing the average daily consumption of fuels by electric public utility plants shows that the fuel consumed in November, 1919, and in November, 1922, was very nearly the same. The production of electricity, however, in November, 1922, was about 25 per cent greater than in November, 1919, indicating a remarkable increase in efficiency in the utilization of fuels and in plant operation during the past three years. This represents the saving of about 750,000 tons of coal and its equivalent in other fuels in a single month as compared with November, 1919."

STATISTICS compiled by the government show that the average daily consumption of fuel by electric light and power companies during 1922 was slightly less than the average for 1919. Yet there were 13,000,000,000 more kilowatt-hours generated in 1922 than in 1919!

Thus there was an actual saving in fuel in 1922 as compared with 1919, due to the greater efficiency of electric public utilities and to water-power development, of at least 15,000,000 tons. Truly this is a most creditable showing for an industry already quite efficient, and is a wonderful tribute to the enterprise, skill and resourcefulness of those who have put their thought and labor into it.

Wigginton E. Creed

A man with progressive views on public policy, utility regulation and the development of national resources in the West.

FUNDAMENTALLY the theory of the American nation is based upon the rights and duties of the individual, with government a necessary provision for safeguarding the common interests. There is perhaps no figure in the public utility field today who is more imbued with this idea than Wigginton E. Creed, president of the Pacific Gas & Electric Company. He believes that individual enjoyment of rights and performance of duties is best expressed in private operation of business. This belief has been well expressed during Mr. Creed's leadership of the Pacific Gas & Electric Company since 1920, but it had its inception long before. As president of the East Bay Water Company, just previous to taking up his present work, he had already distinguished himself by his progressive views on public policy, utility regulation and competent organization. He tolerates nothing less than good service from public servants, but in return he asks for public confidence.

Mr. Creed was born in Fresno, Cal., and educated in the public schools of Oakland and the University of California. After graduation in 1897 he taught school for some time in order that he might continue his study of the law. An active legal practice followed, but even while so employed his interest had begun to focus upon the public utility problem, and when questions of municipal rates threatened to prove troublesome for the Contra Costa Water Company Mr. Creed was persuaded to take charge of the litigation for that company. So thorough was his mastery of the situation that upon the successful termination of the case he was besought to take the presidency of the company and thus became the chief figure in its reorganization and complete financial rehabilitation. Since that time he has been actively associated with the public utility business in California.

With a keen, analytical mind and a grasp of financial problems which enables him to handle business situations with ability Mr. Creed combines great force in public speaking. He understands the importance of public relationships and is today one of the most distinguished figures in the public utility field, not only in the West, but in the nation at large.

In addition to his public service work, he is active in the management of many industrial organizations. As chief executive of the Columbia Steel Company he has been instrumental in preparing for an extension of the steel industry on the Pacific Coast.

As president of the Pacific Gas & Electric Company Mr. Creed has been influential in the building of a chain of five hydro-electric plants on the Pit River to develop 600,000 hp. of electrical energy for the use of San Francisco and other coast cities.

Editorial Comment

Electrical World, January 13, 1923

Volume 81 Number 2

Regional Research Overcomes Many Objections

IT HAS been said by skeptics that the sum total of achievements of a committee is inversely as the cube of the number of its members. This applies in particular to national committees of volunteer workers widely scattered geographically. When it comes to research, a kind of work which demands utmost concentration and continuous effort, the exponent 3 in the above adage must be probably raised considerably. Its exact value will be found in time from the meager results of the work of some of the research committees organized by the National Research Council.

We therefore note with pleasure an improvement in the usual method of committee work in the so-called regional research recently adopted by the American Welding Society. It seems that a year or two ago such a regional research committee (on arc welding of cast iron) was organized, with all the members living in and around Albany and Schenectady. The committee made splendid progress; in fact, as stated in the *Journal* of the society, the progress was at a rate approximately four times as fast as could be expected from a nationally scattered committee. Whatever the unit of "slowness" used in this statement and by whatever means the ratio of four to one was determined, the local committee evidently acquitted itself so well that such regional research is now to be used in other activities of the American Welding Society.

The advantages claimed for this plan are as follows: (a) It permits the holding of regular, frequent meetings without unnecessary loss of time and expenditure of money on the part of committee members. (b) It permits sustained interest of members as the frequency of meetings and their regularity do not allow time for the members to forget what happened at the previous meeting. Useless repetition of discussion is largely eliminated. (c) A particular investigation may be carried to a successful completion in a very short time. (d) It promotes interest in research in a particular locality and renders financing of the costs of investigations much easier.

It is to be hoped that this plan, if successful, may be followed by other national engineering societies.

Tactful Announcements of New Business

WHEN a central-station company obtains a contract from a user of industrial power who has long been on the sales department's list of difficult "prospects" it is only natural that jubilation should be felt in the utility organization. The service to be supplied may be auxiliary or it may displace an isolated plant or other source of power no longer equal to the demands of economy or plant expansion. The mere fact of admission is so gratifying to the central-station manager whose men have been working on the problem, perhaps for years, that there is often a temptation to spread the good news abroad and sometimes, we fear, to overemphasize the part central-station service will henceforth play in the affairs of the industrial establishment.

Faith in the future acquisition of more business may be strong in the central-station family, but in telling local communities that this or that industrial plant has "come over" the utmost care should be taken to state the exact facts of the situation. Any attempt to capitalize a large industrial-power contract by leaving the newspaper reader or other person told of the change to infer that the central station is going to be the "Mr. Fixit" of the community is very poor policy. Manufacturers who have long operated private plants are often proud of their equipment and personnel, and announcements of the adoption of central-station service should be free from objectionable "slants."

A newspaper advertisement or story which expresses or implies the idea that a victory has been won over the industrial plant by the central-station company, or which intimates that the service to be supplied cuts more figure than it actually does in the plant's activities, is a mistake. Of course, it is hardly a secret if an industrial concern decides to buy central-station energy; but tact in announcing such a contract and a disposition to show the new customer a copy of the reading or advertising matter before it goes out will help to insure good feeling all around. No customer should be exploited without his consent. The economies of central-station service are too well established to require ill-advised and blatant announcements of what is going to be done. It is far better to make news announcements simple and accurate, with the approval of the customer, leaving until later the publication of results.

Phenomenal Increase in Water-Power Development

WHEN the policy of the national government with relation to water-power development was expressed in the act of 1920 the assumption was that privately owned and publicly regulated electric utilities would undertake to harness the water courses of the country for the general welfare. To that end the law was designed as well as the rules and regulations drawn up under it. That the plan was wise and practicable is proved by the results. More water-power developments are under construction at the present time than at any previous period in the nation's history. Since the act was passed the Federal Power Commission has issued sixty-nine final permits and sixty-five licenses involving installations aggregating 5,000,000 hp. Thus within two years the country has witnessed 300 per cent more water-power development than was constructed under federal authorization in the twenty years preceding the

passage of the present act, showing that water-power development may be promoted or retarded according to the character of the governing laws. It is of course fortunate that the administration of the water-power laws is in the hands of so experienced and qualified an engineer as O. C. Merrill, whose vision broadens with the passing years.

According to statistics published in last week's issue there were on file on Dec. 1 with the Federal Power Commission three hundred applications for water-power development, involving a maximum installation of 27,800,000 hp. Not all of this is capable of immediate development, but the record shows that approximately three-fourths of a billion dollars is involved in projects now under permit. The electrical industry could not at once command all of the money necessary to carry out complete development of all the water powers of the country, nor is other industry in any position at once to absorb the power. While it is recognized that development must precede use, and that the two must travel hand in hand, it must be recognized that the greatest water powers are remote from the great industrial centers. That is to say, industry hovers along the Atlantic seaboard, whereas our greatest water powers are west of the Rockies. There are, however, great water-power possibilities in the Appalachian region and these are being developed as quickly as capital can be martialed and use found for the power.

The country is thoroughly educated to the use of more and more water power, and the constant bickering and strife over coal production simply serves to hasten the day when every watercourse capable of economic development will be harnessed. Great as has been the progress within the past two years, indications are that this phenomenal rate of growth will not only be maintained but considerably increased within the next decade. Economic conditions are so shaping themselves as to bring this about.

Power Factor and the Consumer

ONE of the broadest fields for economic engineering effort is to be found in connection with power-factor improvement. Each year there is a wider recognition of the necessity for establishing standards limiting the amount of reactive power to be supplied by the central station. In the relation between consumer and utility the final word in power-factor correction rests with the consumer. The small user of power is in general the greatest offender, and the reason for this is obvious. Limitations exist in the type of equipment he can utilize in his business, involving questions of speed, size and number of motors, etc. This class of consumer rarely selects his own equipment, but he relies on machinery or motor salesmen, his contractor or the power sales force. With changes in type or amount of production his power demands may change so that a correctly designed installation at the start yields a low power factor under the new conditions.

Surveys made by some of the larger companies indicate the necessity of periodic power-service tests if the best interests of the consumer are to be conserved. There is no sovereign remedy for power-factor troubles. As is elsewhere pointed out in this issue in an article by L. J. Murphy, power-factor correction is a real engineering question and each case must be handled with due consideration of all the economic features which are involved.

The World's Work in Electricity

TO SUMMARIZE the world's consumption of electrical energy would appear to be a colossal task. It does not, of course, admit of exact knowledge, but every country can with some degree of precision estimate its own quota, and the final addition may be reckoned at least a good approximation to the truth. Such a calculation is more likely to understate the facts than to overstate them, because in every country there are electrical plants which may escape notice because of their small size or isolation, and their aggregate output might add materially to the figures reported. The ELECTRICAL WORLD'S tabulation, which was presented in last week's issue, relates to the last year for which data are obtainable from the far-spread territory included, and the prodigious total of kilowatt-hours consumed in 1920 rises to substantially a hundred billion. Two years' additional growth has doubtless caused even this aggregate to be surpassed. Whatever sources of minor error may affect the total, the general relations between the uses of electricity in one or another region appear with reasonable accuracy, and comparisons of this sort are decidedly instructive.

Of course, it is a familiar fact that electrical output on the North American Continent is relatively very large. It is, indeed, more than half—about 55 per cent—of the total, of which percentage about nine-tenths is in the United States. It is interesting, however, to know that Canada outruns us in the uses of electricity. A larger percentage of her population live in electrically lighted abodes than is the case south of the international border, and the total kilowatt-hours consumed per inhabitant in Canada is 30 per cent greater than here. When we cast about from country to country to see where the next place in the line belongs we find that as regards general distribution the third honor goes to New Zealand. Japan, however, follows the United States in the actual number of inhabitants living in electrically lighted dwellings, thereby offering a market for domestic appliances second only to that of the United States. Again, Switzerland, although slightly inferior in the distribution of electric light as such, heads the entire list in the total use of electrical energy, with 700 kw.-hr. per year per inhabitant. With more than three-fourths of her total available water power already developed, surely the little republic is making wonderful use of its "white coal."

On the whole, however, the world's water power is very badly developed indeed, less than 6 per cent of the potential minimum being already utilized. In percentage of water power kept busy Switzerland naturally stands at the head, with Germany a very close second and the United Kingdom a bad third, but still a little ahead of the United States.

The world as a whole is producing nearly twice as much electrical energy from fuel-burning plants as from water power. The moral should be evident. We have in the United States coal-burning and oil-burning plants rated roughly at 18,500,000 kw., as against hydro-electric properties rated at less than 6,000,000 kw. Canada, with relatively more water and less coal, reverses the ratio in a very striking manner, nearly 90 per cent of the generator rating being from water power. If our fuel supply is to be saved, we must from grim necessity turn more and more to water. With half the world's consumption of energy, the United States is using approxi-

mately two-thirds of the world's whole output in steam-driven apparatus. Consider what the economic results would be if our water power were put to as good use as that in Switzerland or Germany.

With the present grave fuel situation, it should be sufficiently clear that we cannot afford to go on for long in our present path, that we must at all hazards make better use of our water power, and that the efforts of our governments should be turned to encouraging rather than hampering the immediate utilization of every stream that gives hope of economic development.

Uniform Classification of Accounts

CALIFORNIA at times chooses to follow her own notions rather than join with her sister states for the sake of uniformity. Where the honor or rights of the state are concerned such a course is commendable. No state can guard too jealously those rights and privileges not vested in the national government by the Constitution. We are not sticklers for uniformity merely for uniformity's sake, because that fetish stifles initiative. Too often it "gets by" under the guise of efficiency. However, there are uniformities which, viewed from any angle, are desirable, and to reject them is not always wise or prudent. We are surprised to note, therefore, that the California Railroad Commission has adopted the classification of accounts of the Federal Power Commission instead of that just promulgated by the National Association of Railway and Utilities Commissioners. The latter classification was revised especially to meet the desires of Far Western companies for a functional set-up of fixed-capital accounts, and, with other amendments passed at Detroit last month, the classification was presumed to meet all the requirements of utilities and state regulatory bodies. The Federal Power Commission's classification, although based largely on that of the commissioners, has injected into it certain mandatory practices of the Interstate Commerce Commission which are not applicable to the electrical industry and which do not conform with accepted principles of accounting. Knowing the progressiveness of the California Railroad Commission, we cannot feel that it will long retain an obsolete accounting system in place of one that is demonstrably sound and workable.

More Light Needed on Transients

GOOD service, continuous and dependable, is the ideal of electric utilities, and the energies of the engineers engaged in developing the art are largely devoted to the realization of this ideal. But this very feature of dependable service is one of the real limiting factors in promoting the more extended use of high-voltage systems. Upon the technical or engineering limits involved in extending the voltage upward, and therefore in extending the economic transmission distance of transmission lines, research and thought have made less headway than in most other electrical lines since the time of Maxwell.

As is well known, whenever a change occurs in the steady conditions of an electrical system abnormal disturbances in the nature of high voltage or current surges are introduced. These disturbances may occur when energizing a line, opening a line, putting on a load or paralleling two lines, or they may result from grounds or short circuits. Whatever their cause, they seldom occur twice in the same place or form, and too frequently they cause service interruptions.

The problem of gaining accurate knowledge of these transients and of protecting the system against interruption is far from a solution. To start with, only the fundamental fact is known that these time and space transients occur in different parts of the system and involve an energy change and dissipation. An exact knowledge of the alternation and distortion of the disturbing waves is missing, and to complicate matters there is a disagreement of opinion as to the actions which cause attenuation and distortion.

It is agreed that Joulean and dielectric losses produce both distortion and attenuation, but in what degree is still a question. Authorities like Steinmetz and Carson disagree as to the effect of radiation and even as to the mechanism of propagation of these waves, and thus quantitative underlying principles are missing whereby the practical equipment can be made to eliminate the disturbances or render them harmless.

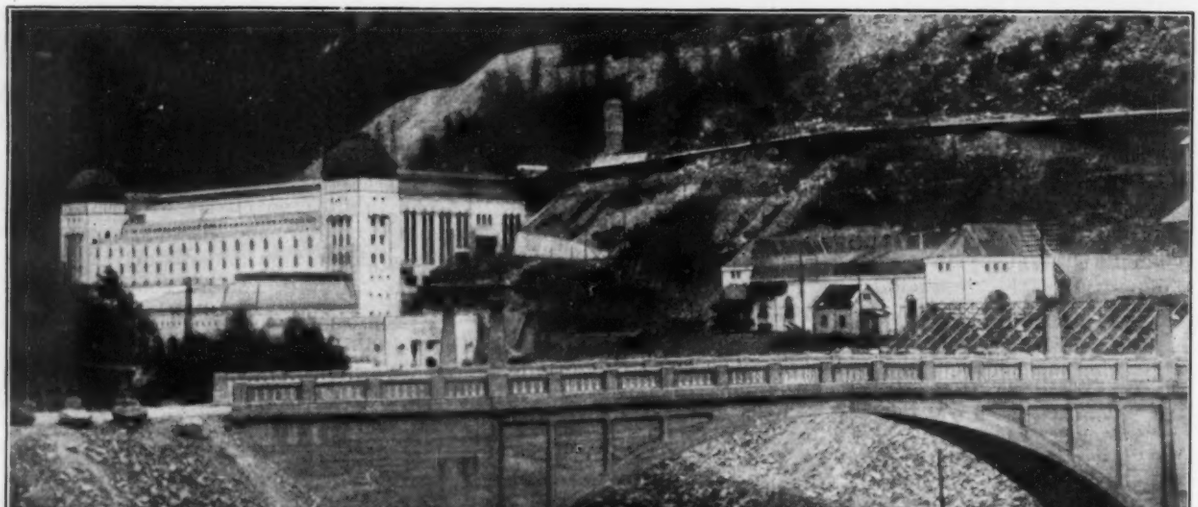
Research work of the highest grade is needed on this problem because its solution will have a tremendous influence on the introduction of the economies resulting from the more extensive use of high-tension interconnected systems.

Transmission or Distribution, Which Is It?

ALMOST always when discussion concerning lines for the carrying of electrical energy arises those taking part in it fall into confusion in using the terms "transmission" and "distribution." This is usually because the meaning of the words is thought of in terms of voltage. Circuits of a given voltage may perform transmission functions on one property and distribution functions on another. This confusion of terms is bad enough in technical and operating discussion, but in matters of accounting it is almost past remedy. Accounting classifications are usually designed to maintain a separation of the two property values. Owing to the shifting of lines from the performance of one function to the performance of the other it is a question whether any accounting classification that has existed over a fairly long period of years can be unraveled so as to tell the true story of investment as between the two.

To get away from the confusion it will be necessary to think of circuits in terms of functions performed rather than in terms of voltage. An analysis of the mental conception of the two things that seems to exist in every discussion indicates that "transmission" covers the bulk transfer of power from a generating point for some distance to a center of distribution, such as a substation, from which it is taken over other circuits. "Distribution" covers the circuits carrying the energy from the point where it is delivered by bulk transmission circuits to the final consumer. Suggestions have been made in private and informal discussions that the definitions indicated by the above distribution would go a long way toward clearing up the confusion, since the separation is based on functions performed rather than on an arbitrary assumption.

The determination of the question will have added significance of great importance to consumer and operator alike if the recent recommendation of the utility rate committee of the National Association of Railway and Utility Commissioners becomes standard practice. This committee recommended that "transmission" systems be considered a part of "plant" in valuation, rate-base and rate-analysis studies.



European Power Stations Are Noted for Their Architecture

Views of hydro-electric power stations in Norway, showing how they harmonize with their surroundings.

The upper view shows the Saaheim station in Rjukan, which develops 150,000 hp. The station building is of reinforced concrete.

The Tyssedal station, shown in center, is on a lake with storage of 300,000,000 cubic meters.

The lower view shows the Nedre Lerfoss station, near Trondhjeim. The building is of gray granite and contains three units with a total rating of 10,500 hp.

Automatic Substations Success in St. Paul

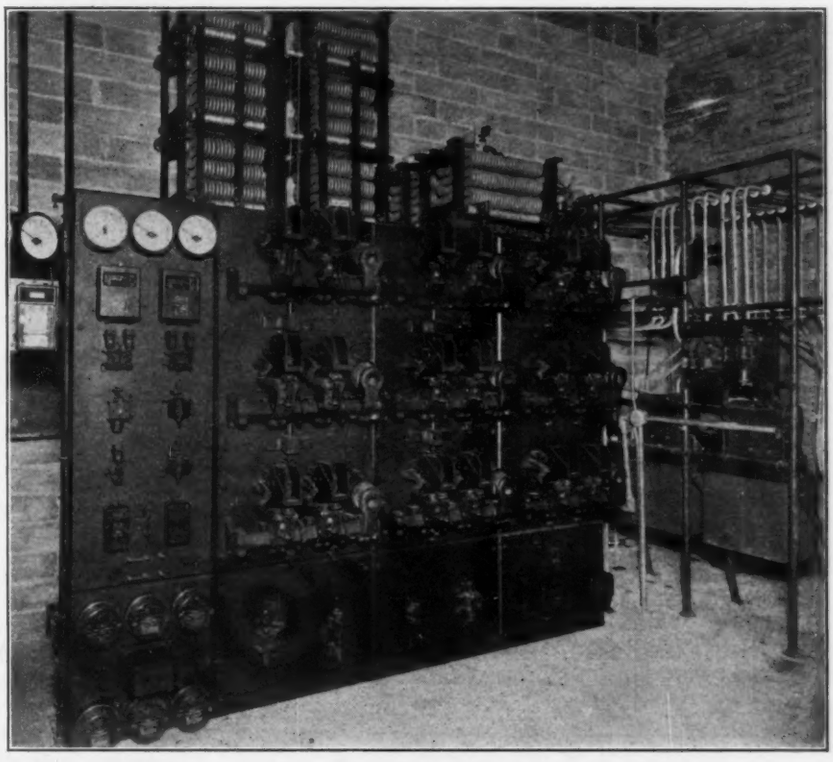
Two Years' Experience of St. Paul Gas Light Company Brings Entirely Satisfactory Results—Both Alternating-Current and Direct-Current Stations in Use

By ROBERT REINBOLD
Superintendent of Switchboards St. Paul Gas Light Company

WHAT is the legitimate field of the automatic substation? This article describes the main features of two installations in St. Paul which have proved so successful over two years of service that it is difficult to discuss operating problems. In short, the installations have functioned with only routine adjustments that cannot be styled troubles and have become a necessary part of the system. The natural inquiry is why should such substations not be applied to all situations, particularly the big direct-current areas in the big metropolitan centers. Engineers who have investigated them for the larger service point out that they are so far installed on small Edison networks with a maximum of approximately 25,000 kw. in load, where it is the policy to restrict direct-current load and where future growth will not justify substations with operators, and that possibly they can be applied in the lightly loaded outer territory surrounding a large direct-current territory. Whether they can be adapted to a heavily loaded business district where faulty operation of a single relay could drop loads up to 10,000 kw. and cause progressive disturbances to the rest of a network carrying 100,000 kw. or upward is a question to which the investigators have not been able to return a satisfactory answer. As an instance of success in the smaller field the St. Paul installation, embracing both an alternating current and a direct-current substation, is worth studying and affords evidence of worthy service in this application.

ABOUT two years ago the first three-wire full automatic motor-generator applied to an Edison three-wire direct-current system was put in operation. This station, owned by the St. Paul Gas Light Company, has continued in successful operation ever since. In this article it will be described along with an alternating-current automatic substation owned by the same company and built during the summer of 1920.

The fulfillment of a contract to supply direct current to a large building then being erected made it necessary either to run more direct-current feeders from the nearest station, located three blocks distant, to boost the direct-current network already somewhat overloaded at this point, or to install a new station in or near the building. The load on the nearest substation had reached the practical limit of its capacity, making additional equipment imperative, but no space for it was available. Insufficient duct space in the street made the running of new feeders an expensive undertaking. The load expected from the building was less than 500 kw.; therefore manual operation was not to be considered. Thus the decision which brought about the first attempt at full automatic operation was a matter of economy and circumstance.



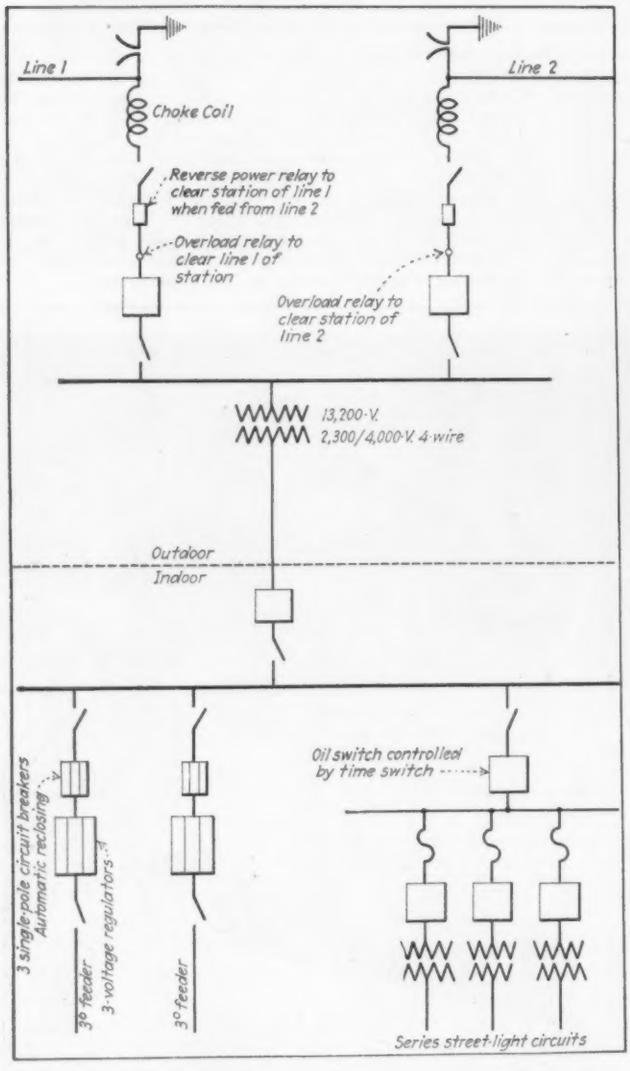
SWITCHBOARD AND MACHINE INSTALLATION AT THE AUTOMATIC DIRECT-CURRENT SUBSTATION OF THE ST. PAUL COMPANY

The apparatus is guarded from the effects of high temperature by temperature relays and an unusually complete ventilating system.

This station is in the new building, on the floor of the engine room below the sub-basement. The generator is rated at 125/250 volts, 500 kw., three-wire, with a nearly flat voltage characteristic, drooping slightly beyond full load. The motor is synchronous, rated at 1,200 r.p.m., three-phase, 4,000 volts, 60 cycles, direct-connected to the generator and mounted on the same bedplate with it. The automatic equipment is of the lock-out type, and each operation is carefully "shadowed" to prevent trouble in the event of failure on the part of any relay. The motor is protected against burn-out from continued overload or abnormally high room temperature at normal load, owing to failure of the ventilating system, by a temperature relay. All bearings are also protected by temperature relays. Each opening in the walls of the station is guarded by a self-closing fire door held open by a fuse link.

An 8-in. tile wall separates the station equipment from other equipment on the same floor, forming an inclosure about 20 ft. x 20 ft. in size and 24 ft. high. The floor is about 50 ft. below the street level, making ventilation somewhat difficult, since it was found not feasible to run a ventilation duct outside the building. The difficulty, however, was overcome by installing two exhaust fans in

the wall near the floor to move the cold air into the room, and a large opening near the ceiling on the opposite wall permitted the heated air to escape into the engine room and sub-basement. This has at no time caused uncomfortable temperatures in the sub-basement, since the space is large and below the street level. Placing of the fans near the floor makes inspection and repairs easier than if they were installed near the ceiling in the usual way. These fans have a total capacity of about 16,000 cu.ft. per minute. The smaller fan runs only when the station



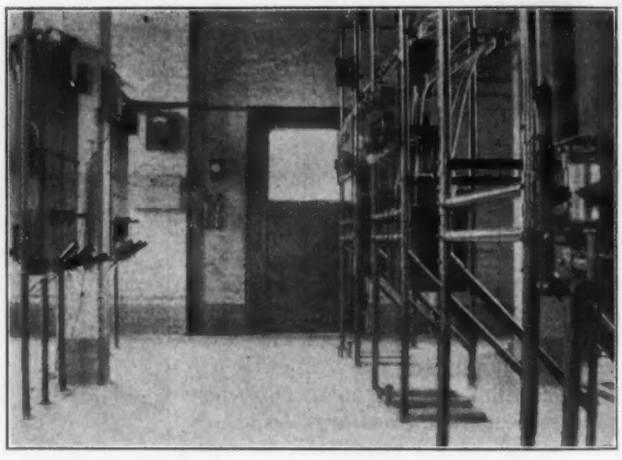
TYPICAL WIRING DIAGRAM OF ALTERNATING-CURRENT AUTOMATIC SUBSTATION USED BY THE ST. PAUL GAS LIGHT COMPANY

is in operation, but it was found an advantage to have the other fan run continuously, so that if the station is automatically shut down on account of overload the room and motor temperature is quickly brought down to a point where the station will automatically return to service.

The operating conditions required the equipment to be so arranged that in the event of low voltage on the direct-current network caused by trouble at the manual station the control will automatically insert resistance between the station and the system, thus keeping the voltage up to standard on the building service. The resistors are protected by temperature relays, which control the automatic switches connecting the station with the network, thus enabling the station to separate itself automatically from the network if the voltage reaches a very low value and causes overheating of the resistors.

It was found very important that the operator at the nearest direct-current station should know at all times what the automatic station is doing. Therefore two wires were run between these stations and the neutral of the direct-current network is being used as common return, forming two circuits, one of which is connected to the secondaries of a current transformer in one of the motor leads of the automatic station and at the manual station to an ammeter, thus providing the operators with indications of the load carried by the automatic station. The other circuit is connected to a signal lamp at the manual station and is controlled by the resistor-contactor at the automatic station. It indicates to the operator the cutting in of the resistor between the network and the station.

At the manual station advantage is taken of the flat voltage characteristic of the generator at the automatic



TO SAVE SPACE THE USUAL SWITCHBOARD PANELS ARE OMITTED IN THE SEMI-OUTDOOR TYPE ALTERNATING-CURRENT AUTOMATIC SUBSTATION OF THE ST. PAUL COMPANY

Instruments, relays and reclosing devices are placed on small transite panels mounted on the switch-supporting structures.

station when the operator, if necessary, shifts the load to or from the automatic station by a slight change in the voltage at the manual station.

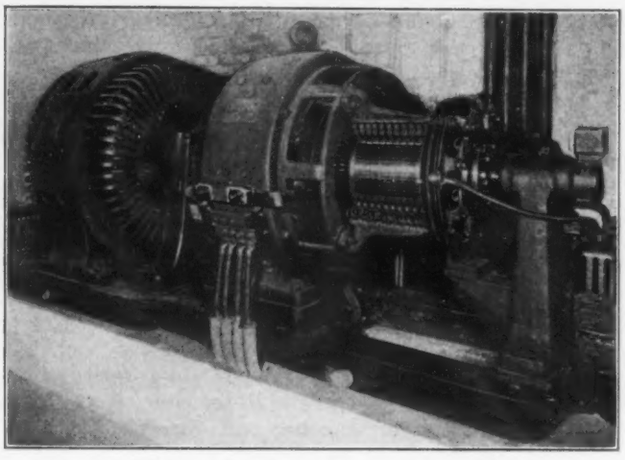
One of the difficulties and almost the only one to be overcome during the trial immediately following the completion of the installation was the "coming in" out of step of the motor on recovery of the alternating-current voltage after a momentary failure before the generator voltage had fallen to a sufficiently low value, since the motor fields were connected permanently across the generator leads. This possibility was removed by placing a contactor in the motor-field circuit to open the field when the running switch of the motor opened, thus at once reducing the generator voltage to zero. The contactor automatically recloses when the motor starting switch closes, permitting the generator to build up.

The operation of the automatic station has been entirely satisfactory, and it has also proved very valuable in emergencies such as those caused by heavy-voltage fluctuations due to the failure of a transmission line throwing all synchronous apparatus out of step. In all such cases the automatic station immediately came back, and with the storage battery, which also comes in automatically under such conditions, carried

the entire direct-current load until the manual stations could be returned to service. This station is visited daily to change charts on graphic instruments and read the meters. Once a week a general inspection is made and all contacts subjected to dust and arcing are cleaned.

THE ALTERNATING-CURRENT STATION

The alternating-current automatic station referred to in the beginning of this article is of the semi-outdoor type. All of the high-tension equipment, consisting of transformers, lightning arresters, oil switches, etc., is located in the yard. Feeder regulators, oil circuit breakers, constant-current transformers and instruments for street lighting are in the station building. The station being in a residence district, special effort was made in the design of the building and its surroundings to insure an attractive appearance. The building is of brick and concrete construction and fireproof throughout. Floor drains are provided for each oil circuit breaker and feeder regulator, so that in case



ONE OF THE MOTOR GENERATORS USED IN DIRECT-CURRENT SUBSTATIONS

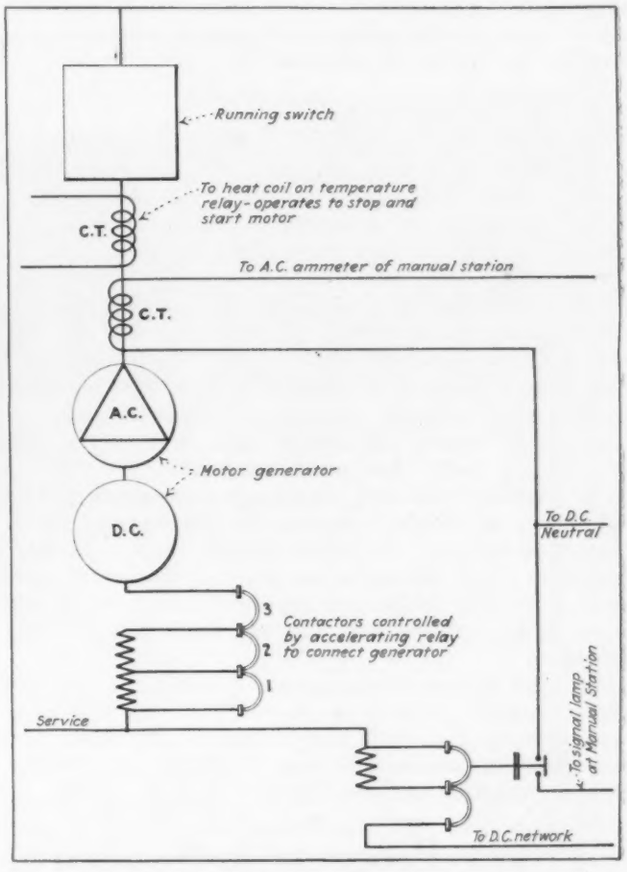
an oil container is ruptured the oil is quickly drained out of the building into a tank buried in the yard, thus removing fire hazards.

Space was provided for three 1,000-kva., four-wire, three-phase, 2,300/4,000-volt feeders with a single-phase regulator and single-pole independently controlled oil circuit breaker in each phase. Each circuit breaker is provided with an overload relay and a reclosing device, the latter set to reclose the breaker twice before locking out. The time interval between opening and closing is two and one-half seconds. The overload relays are set for 135 per cent load and a definite minimum time setting of 1 second at 1,000 per cent of load. This has been found completely successful thus far. Numerous cases of line trouble from severe storms have caused the reclosing device to operate several times without a single outage of more than two and one-half seconds, which affords evidence of reliability in service.

Only one ammeter is used for the load indication on these feeders. Transfer of the ammeter is made to any phase of either of the feeders by simple arrangement of three three-circuit ammeter switches, leaving room for an additional feeder to be connected through another ammeter switch.

Overload relays, reclosing devices and ammeter switches are mounted on small transite panels set in the framework supporting the busbars, disconnecting switches and oil circuit breakers, thus doing away with the usual switchboard panels, and a considerable saving of space is effected thereby.

In addition to the two 1,000-kva. regulated feeders there are seven 30-kw. constant-current transformers, including the necessary equipment for seven series street-lighting circuits. These transformers are connected to an auxiliary bus through oil switches and to the main bus through an oil switch controlled by a time switch. In this manner the turning on and off of the street-lighting circuits is taken care of automatically. One small marble panel is used for each series circuit on which are mounted an ammeter and an oil switch. These panels are arranged in pairs, allowing space



TYPICAL WIRING DIAGRAM OF DIRECT-CURRENT AUTOMATIC SUBSTATION USED BY THE ST. PAUL GAS LIGHT COMPANY

between pairs for passageways to the rear of the panels and to permit removal and replacement of the transformers.

Two alarm bells are placed in the station. One vibrates slowly and rings whenever a feeder switch is locked out automatically owing to a permanent short circuit on the feeder. The other bell, which vibrates rapidly and is muffled, rings only when the station is dead owing to failure of the 13,000-volt trunk lines which feed it. The use of alarm bells in an unattended station seems strange until it is explained that a device has been installed in connection with the telephone which enables the load dispatcher to listen in from any telephone in the city to ascertain the operating conditions of the station. If an outage is reported, the trouble dispatcher may listen in and know whether it is caused by an open breaker, dead station or line trouble. The control current for closing and opening switches is 24 volts direct current, supplied by four 6-volt, 80-amp.-hr. automobile-

starting batteries. These are tested daily and recharged once a month by means of a small portable arc rectifier located in the station.

The outdoor part of this station consists of four 600-kva., 13,200/2,300-volt step-down transformers, fed by two 13,000-volt trunk lines through two 25,000-volt outdoor-type oil circuit breakers and protected by two electrolytic lightning arresters. Normally, however, only one line is in use; the other is used only in emergencies and controlled at the steam station. The metering is done on the high-tension side and outdoor metering transformers are used. The meters and relays are installed in the building. All supporting framework is made of 1¼-in. iron pipe and standard reamed fittings. Copper tubing is used for both high-tension and low-tension bus, and the spare transformer is provided with leads so that it can be connected in a few minutes.

ROUTINE INSPECTION

This station is visited twice daily, except Sunday, when only one visit is made. The purpose of these visits is to test the series circuits, batteries and reclosing devices, charging the arresters, changing charts on the graphic instruments and reading the meters.

Another station, which contains both alternating-current and direct-current equipment, is being changed from manual to automatic operation and will embody nearly all the automatic features contained in the stations above described together with new features since developed. Automatic operation of stations generally shows very gratifying results both in economy and service, but each case must be decided individually as no standard procedure can be laid down which will be suitable in all or perhaps even the majority of cases. Manual operation of stations cannot equal automatic operation. It is impossible for any combination of operators so to co-ordinate their movements that the results equal in promptness and accuracy those of automatic operation.

For the successful operation of automatic stations rigid inspection must be the rule. This inspection must be systematic, periodical and thorough. Spasmodic and superficial inspection will lead to neglect and unsatisfactory operation and possibly to disastrous results.

Power Progress in Sweden

Large Increase in High-Tension Transmission Mileage —Interconnected System Is Now Favored by Co-operative Committee

AT A RECENT meeting of the Swedish Engineering Association the activities during the last five-year period of the Royal Swedish Board of Waterfalls were outlined by W. Borgquist, chief director of the association's electrical department. The speaker pointed out that, while the increase in aggregate generating capacity of the Swedish state plants has been rather moderate, the total installed capacity growing from about 160,000 kva. to 250,000 kva., there has been a tremendous development of transmission and distribution facilities. During the coal crisis of the war an insistent cry for electric service was raised by communities, industrials and farmers everywhere, and the construction of distribution lines therefore was rushed at top speed all over the country. During the last five years the total length of state-operated high-tension lines then increased from 700 km. to 1,500 km., while the length of secondary distribution lines operated at 20,000 volts to 10,000 volts in the same period increased from 800 km. to about 3,700 km. The return of the central Swedish system reached a maximum of 8 per cent during 1917, but since then it has been slowly sinking, last year's books showing a margin of 5.3 per cent. At the close of 1921 the total investment amounted to about 130,000,000 crowns,* exclusive of stations now under construction.

An important phase in last year's development was the building of a 315-km., 132,000-volt tie line right across Sweden, from Trollhättan to Västeras. This line is the first in Europe to be operated at so high a voltage, and the towers are so constructed that after reinsulation the voltage may be raised to 220,000 volts if conditions warrant. Through this line the state plants in middle Sweden are connected into a great central block, with a generating capacity of about 200,000 kw. This has made possible the establishment during times of water shortage of a rational load-dispatching service, controlled from a central office in Stockholm. At times of surplus power from Trolhättan about 20,000 kw. has been transmitted over the line, which has allowed the steam reserve plant at Västeras to remain idle most of the time. An important link in the power-conserving scheme is the new hydro-electric station at Motala. Owing to its position between two lakes this plant offers excellent opportunities for establishing complete hydraulic regulation over a period of a week, and therefore it should be of great importance as a peak-load plant. The ultimate capacity of the station is 25,000 kw., only one-third being yet installed.

SUPERPOWER SYSTEM PLANNED

The Trollhättan tie line is intended to form the first link in a system of extra-high-tension trunk lines which may ultimately span not only Sweden, but Norway and Denmark as well, thus forming an inter-Scandinavian superpower system. It is only a question of time when another link in this system will be built north from Västeras to some large power sites in Norrland, which have been purchased by the Swedish government. Another extension is planned from Trollhättan to the south end of Sweden, to connect the state "central block" with the system of the South Sweden Power Company, Sweden's biggest power enterprise, with a generating capacity of 70,000 kw.

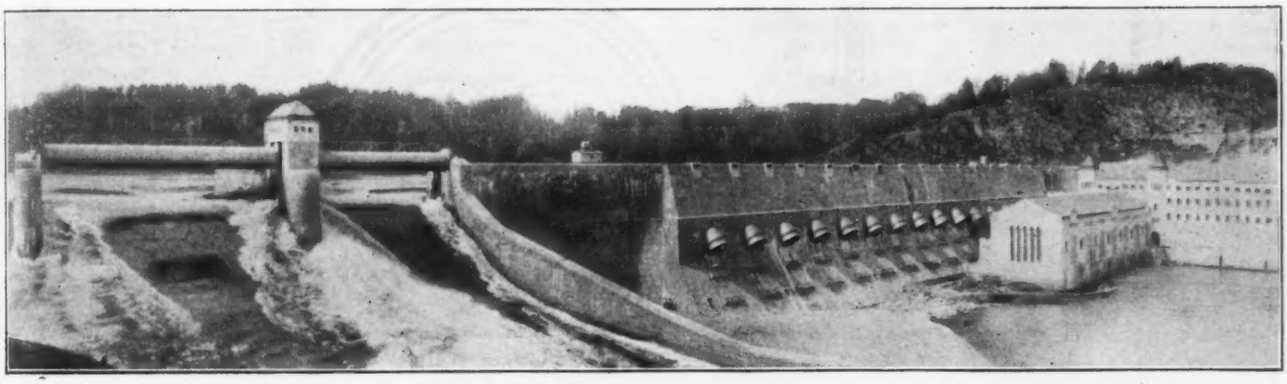
The bigger problem of the inter-Scandinavian system is being studied by a committee of two representatives from each of the three countries involved. The private power system in south Sweden is already connected to the Danish network by a cable in the Strait of Oresund, but plans are under consideration to lay down cables for higher tension and to connect these to a line over Trollhättan to the Norwegian power plants along the river Glommen. There is here not only a question of establishing seasonal power interchange between Sweden and Norway, but the trunk-line system actually would serve to transmit energy from the large water-power resources of Norway right through Sweden and over to a future Danish high-tension distributing system. Interest centers at present on the problem of stability of such a vast system, containing a great number of synchronized stations, widely spaced, where the voltage lag from the first generator to the last consumer will be considerably in excess of 90 deg.

*At the old rate of exchange a Swedish crown was equivalent to about 33 cents.

Hydraulic Power Plant Practice in Northern Europe

Skeptical Regarding Outdoor Installations—Connecting Generators and Transformers Directly—Higher Reactance and Regulators—Oil Circuit Breakers with Multi-Contacts and Explosion Chambers

By CLIFFORD N. ANDERSON
Engineer, Dwight P. Robinson, Inc.



VAMMA STATION, ON THE GLOMMEN RIVER, DEVELOPS 200,000 HP. IT HAS BEEN IN OPERATION SINCE 1915 AND FURNISHES POWER TO CHRISTIANIA

IN NORTHERN Europe one invariably finds that the native engineer gives a large amount of credit to the American engineers for being ultra-practical, but takes credit to himself for being theoretical and for ability to incorporate the artistic in the commonplace. Take, for example, the outdoor switching station. This seems to be confined chiefly to American engineering practice; the European is afraid of it. He is afraid we are leading him astray. He isn't accustomed to observing his transformers and circuit breakers standing in the rain or half covered with snow, and cannot be reconciled to the idea. "It may be all right over there," he will say, "but the climate is too wet over here."

Yet, the few examples the Europeans have are working wonderfully well. Conditions about as severe as any which could be imposed on an outdoor station are found at the station of Bjolvo, situated on the Hardanger fjord on the west coast of Norway. The precipitation here is unusually heavy, with rain nearly three hundred days out of the year, and in winter the station is at times almost half buried in snow. In the six years that this station has been in operation there has not been the least trouble. One of the engineers of the Allgemeine Elektricitäts Gesellschaft said that probably one reason why outdoor stations were not used in Europe was because a start had not been made on them during the war. As far as he could see, a transmission line was only the extension of the buses inside the station, and there ought to be no reason why outdoor stations would not work. In fact, he held, there were conditions under which they most certainly should be recommended.

The power houses as a rule are very attractive, and some of them might be mistaken for medieval castles or similar buildings. Inside walls are tinted with delicate colors, plaster frieze near the top, tiled baseboards and trimmings, clustered lights in the ceiling and ornamental wall luminaires adding to their attractiveness.

Of late years there has been a tendency in Germany to build the switching bay in one or two floors with the transformers separated from the circuit breaker and bus section. All the heavy machinery is thus on the ground floor, the oil breakers on both sides of the bus being operated from a common aisle and the condition of the knife switches being visible to the operator from the ground floor. A typical example is shown in the accompanying illustration which indicates the manner in which the high-tension lines are led outdoors. This method of protecting the entrance insulator from rain and weather is very popular and almost universally employed by German engineers.

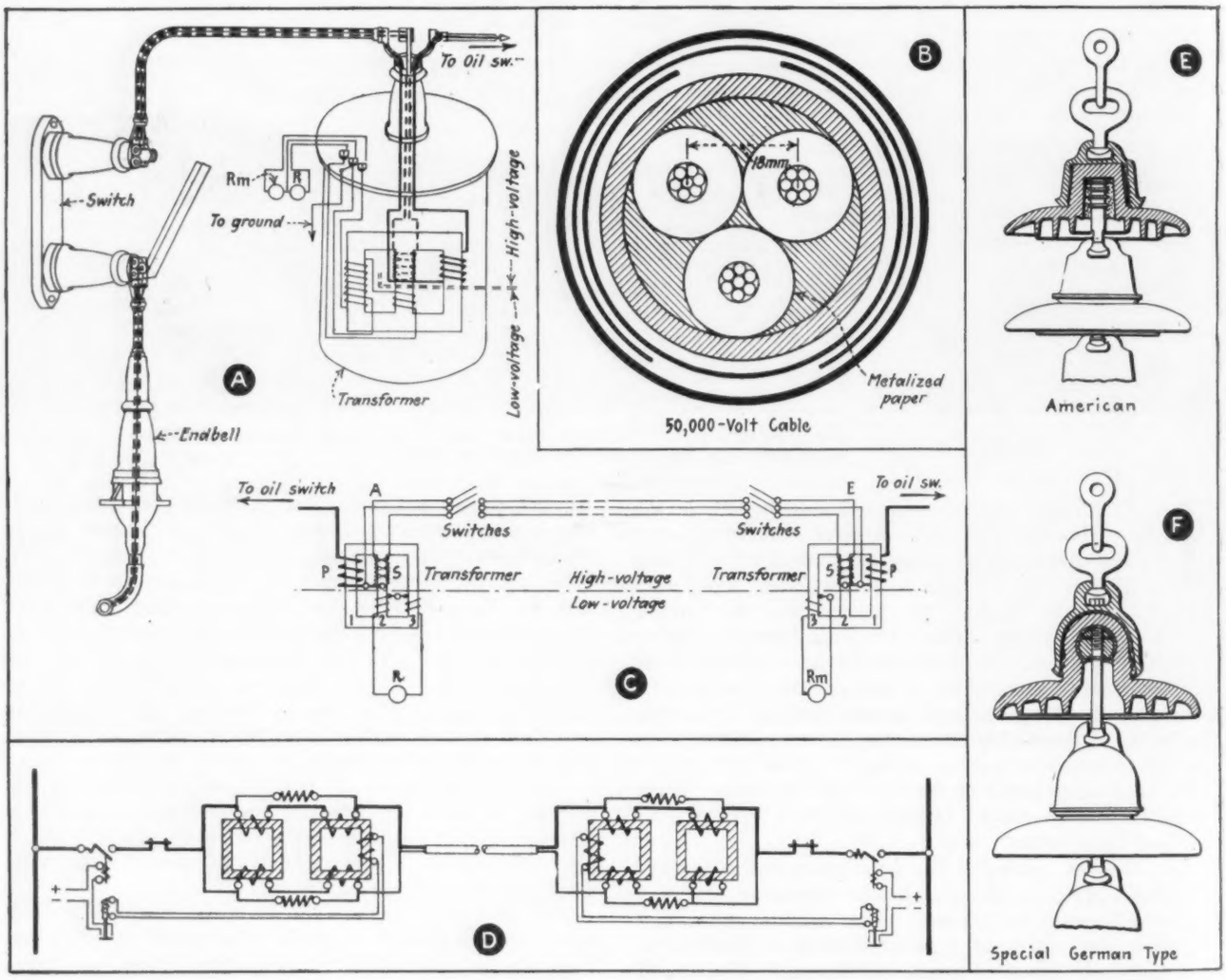
The switching gallery in existing stations usually overlooks the generator room. The newer stations are, however, being built with the control room separated from the generator room, communication with it being made by means of visual signals. Generator and circuit-breaker control are operated from benchboards, while transmission-line control and instruments are mounted on vertical boards. The benchboards are constructed of sheet iron, pebbled and bronzed, and are really more attractive than slate or marble and easier to install.

Connecting Generators and Transformers Directly

Generators are generally wound for 6,000 volts. There are stations built for 10,000, 11,000 and even 15,000 volts, but the tendency of today is toward the lower voltage. The critical breakdown voltage with the machine insulation used abroad, due to brush discharges, is about 35,000 to 40,000 and cannot be raised even by increasing the insulation thickness two or three times. With a safety factor of one to four for 10,000

volts, it is one to seven for 6,000 volts. A higher generator voltage can therefore be secured only at the expense of the safety factor.

With the advent of the larger present-day units the tendency is to regard the generator and the transformer as a unit and to connect them directly together without circuit breakers. Notable German examples of this are the 50,000-kw. generators at the Goldenberg power station and the 25,000-kw. generators at Hirschfeld and Golpa. Formerly generators were built with reactances of only 3 per cent to 4 per cent, and the short-circuit currents might go up to five, ten or even transmission lines, the voltages of the other two phases to ground rise to line voltage. On account of the capacity series coupling between the transformer primary and the secondary windings, the potential of the unaffected phases to ground is distributed over the capacitative series-coupled transformer and the generator to earth in inverse proportion to the capacity of these parts. The capacity of the transformer in relation to the generator is often quite large, and so the generator's voltage to ground may rise to such a high value that it may puncture the generator windings. In order to prevent this, and to limit the current in case



A, C AND D—PFANNKUCH AND LYPRO SYSTEMS OF CABLE PROTECTION. B—CROSS-SECTION OF 50,000-VOLT, THREE-PHASE CABLE. E AND F—COMPARISON OF TYPICAL AMERICAN AND SPECIAL GERMAN PORCELAIN INSULATOR CONSTRUCTION

30 times normal current. Now generators are built with reactances of 7, 8, 9, and even up to 25 and 30 per cent, so that the short-circuit current is reduced to 60 to 80 per cent of normal current with no load excitation and to 1.6 to 1.8 times normal current with light load excitation. In spite of this the short-circuit currents are too large to admit of the low-tension bus system, and breakers as well are avoided. The increase in inherent reactance is at the expense of regulation, but this is taken care of by potential regulators. For more than 500 r.p.m. these generators are more expensive than the ones previously built, but those under 500 r.p.m. are less expensive.

With a ground on one phase of the high-tension of a ground, an ohmic resistance from 0.5 ohm to 2 ohms per generator, computed from the charging current, is connected between the neutral of the generator and ground. The material for the resistance has been of thin resistance bands in a water bath utilizing the cooling water of the transformers. Relays are placed in this circuit which operate the generator oil circuit breakers as soon as the current exceeds 20 per cent normal. With modern power stations where the generator is directly connected with its transformer the relay acts upon the breakers on the high-tension side of the transformer and also simultaneously decreases the generator excitation.

In general, all relay protection, consisting of

excess-current relays set for 20 per cent overload, reverse-power relays on the high-tension side of the transformer, differential relays utilizing the current transformer in the generator neutral, and excess-current relays on the high-tension side of the transformers, act together upon the high-tension breakers and upon the generator excitation. Demagnetization of the fields is accomplished by opening a short-circuiting switch, which introduces a high resistance in the excitation circuit, or by short-circuiting the field.

CABLES USED BETWEEN THE GENERATORS AND TRANSFORMERS

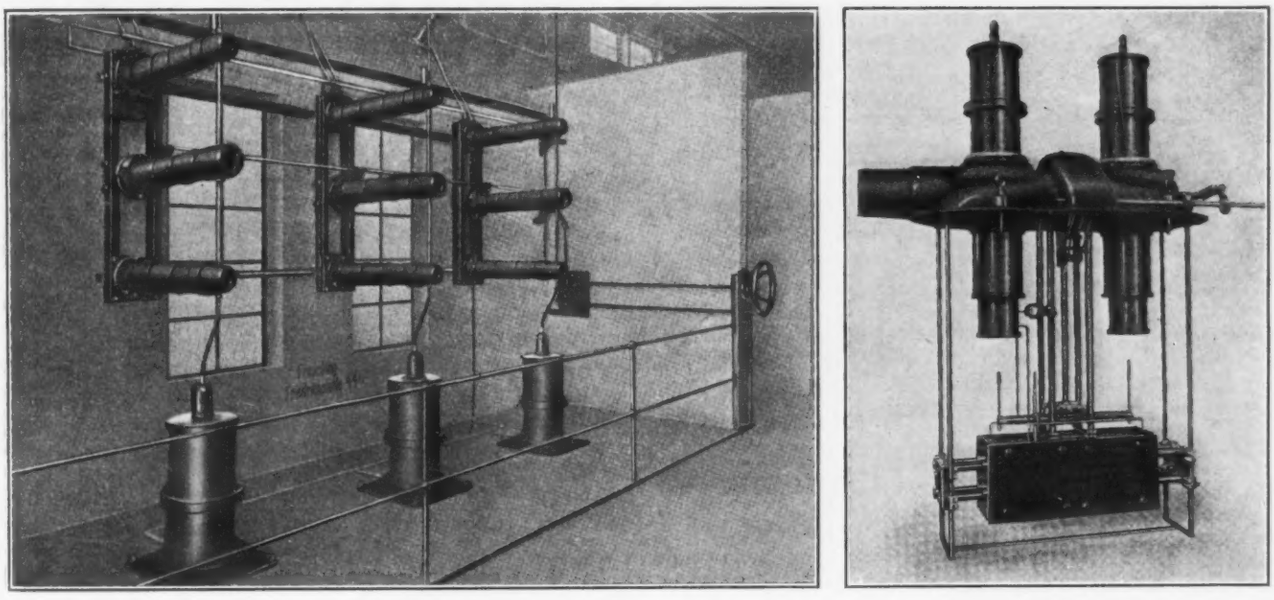
Whenever possible the connection between the generator and the transformer is made by cable instead of by busbars. If a failure occurs on the transmission line, waves with a steep wave front may be set up and capacitatively transmitted to the low-tension side of the transformer. If the connection is by means of buses, these waves may be transmitted directly to the generator and may cause burning out of coils. Cables have a large capacity which attenuates these waves. (In the Golpa station, in Germany, with four 23,000-kva. units installed, nine three-phase copper cables of 185 sq.mm. in cross-section are used.) Where it is not possible to use cable, capacity is sometimes connected in parallel with the busbars. As an added supplement to the condensers, 300 ft. or more of cable is used. As the capacity between primary and secondary windings of large transformers ranges from 0.2 mfd. to 0.5 mfd., the charging currents may be quite large and the precautions are well worth while.

Three-phase transformers are used almost exclusively in Europe as contrasted with three single-phase transformers here. These are now built up to 60,000 kva. rating, and examples are installed at the Rheinisch Westfälian Elektricitätswerke. The transformers are connected delta on the low side and star on the high side.

In order to economize on oil in the large transformers, the container is built as small as possible and consequently the casing is very close to the windings. The windings are therefore in three layers, of which the inside and the outside layers are low-tension and the middle one high-tension. With this method the delta-star system of connection must be used, otherwise stray fields will set up eddy currents in the casing of the transformer.

At the present time transformers are being fitted with reactance coils in the line, but as the transformers are being built with larger and larger safety factors, they will probably be discontinued. For example, a 110-kv. transformer for a Bavarian power station was tested for half an hour at 220 kv. Two per cent of the entrance coils and 2 per cent next to the neutral should stand the operating voltage between two neighboring coils for two minutes. The rest of the coils should stand a potential of 60 kv. between two adjacent coils. Reactance coils for such transformers are considered superfluous.

Oil-circuit-breaker explosions are not feared so much now as formerly. Inflammable oil, even if desirable, cannot be used on account of its attack on the contacts making them unfit for use after several weeks. The English insulate the conductors and insist on a safety factor of seven. Siemens-Schuckert builds containers of extra-heavy boiler plate, while the Allgemeine Elektricitäts-Gesellschaft employs a quenching chamber. With 30 atmospheres pressure inside the quenching chamber there is a pressure of only 0.5 atmosphere on the container wall. For large currents, rapid breaking contacts of 0.01 second are used, and for 110 kv. or more four contacts are used. A 110-kv. breaker with ten contacts manufactured by Brown-Boveri for a power station in Bavaria was tested for 250 kv. and 260 amp., making the rupturing capacity 300,000 kva. Oil breakers for three-phase lines over 35,000 volts are built as three single-phase units. In Germany all large transformers are equipped with breakers employing "fore" contacts, which introduce a resistance before the circuit is actually made. It is noticed on long transmission lines where this type of breaker is not used that occasionally flashover of the entrance insulator at the distant station occurs. The resistance is calculated so



LEFT—100,000-VOLT DISCONNECTING SWITCHES WITH PAPER INSULATORS. RIGHT—100,000-VOLT CIRCUIT BREAKER WITH PAPER TERMINALS

that the charging current causes a 70 to 80 per cent loss in the uncoupled voltage.

Considerable use is made in Germany and to some extent in the Scandinavian countries of apparatus for automatically connecting two generators in parallel. The type most used is one manufactured by Voight & Haefner which employs a voltage relay, a phase relay and a time relay. The operator adjusts the voltage and the frequency of the two machines as near to the same values as possible, and when they are in phase for a sufficient length of time, as determined by the time relay, the generator circuit breaker is closed automatically. The setting of the time relay may be varied, but is usually around five to six seconds.

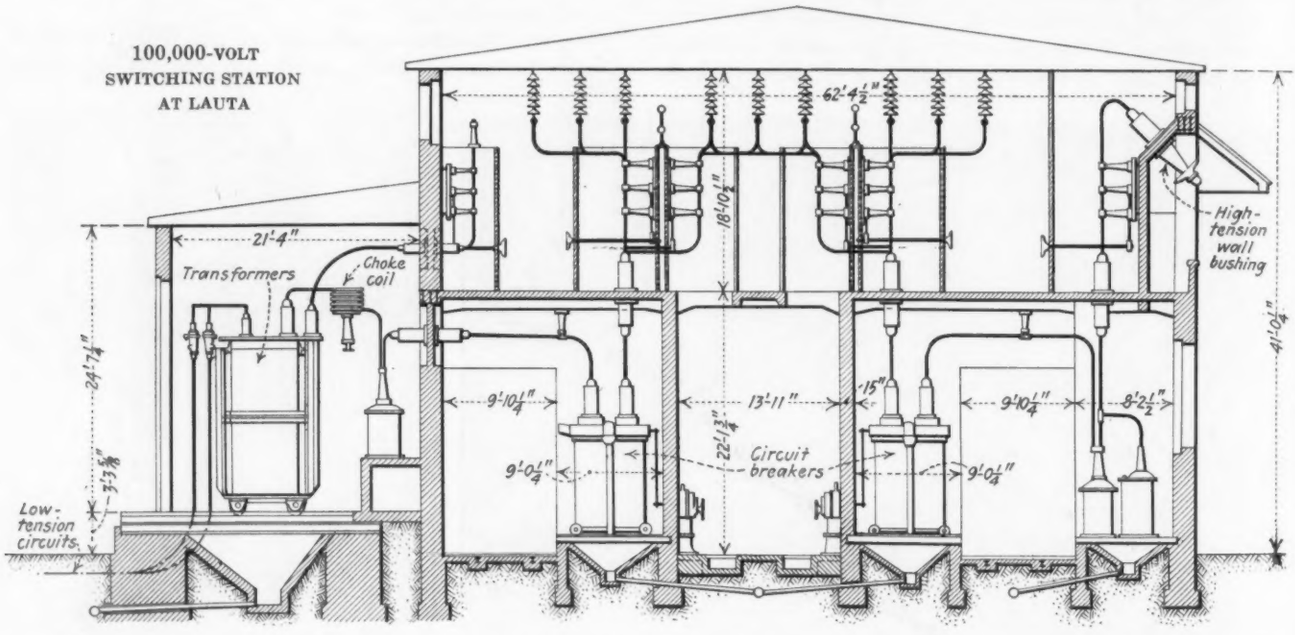
Of late years large-capacity current transformers (200 amp. or more) have been of the air type as these have been found to stand up better under strong dynamic forces. They are well suited for instruments and relays but not accurate enough for meters. Instrument transformers were formerly fused, but it was found that the fuses burned out frequently without cause, so that now only knife switches are used.

Paper Insulators and Porcelain Units Operating in Compression

Considerable interest has been manifested in large insulators of other material than porcelain because it is difficult to get porcelain insulators of the size required for voltages above 110,000. Excellent results have been obtained with paper insulators. The advantages claimed are that they are virtually unbreakable, their length can be adjusted by placing them in a lathe and in case of a flashover the outside layers can be removed, the surface relacquered and the insulator again put in operation. They cannot, however, be used out of doors, and in regions where the humidity is high they cannot even be employed indoors, as the paper is hygroscopic and breakdowns result. In one hydro-electric station in Norway which sought to use them the insulators became badly charred, due no doubt to moisture from the ouside. They are used extensively, however, for bus supports and for large disconnecting switches. They present an attractive appearance. A visit to the large transformer factory of the A.E.G. at Oberschöneweide, near Berlin, disclosed the fact that all its high-voltage transformers have paper-insulator terminals. These are provided with brush-discharge rings which increase the breakdown voltage 50 to 60 per cent.

Suspension Insulators Assembled in Parts After Separate Firing

An unusual and ingenious development in suspension insulators, which is pointed to with a great deal of interest, is shown in an accompanying illustration. Since porcelain shrinks a little on firing, the small doughnut-shaped ring is first fired and shrunk. It is then just small enough to enter the spherical cavity in the top of the insulator, after which the cap and ring are fired together. The ring does not shrink any more, but the outside cap will shrink sufficiently to keep the ring in place inside the cavity. A nut of suitable shape is then placed on the bottom of the ring, and the ring and nut are turned so that the latter is at the top of the cavity, when the bolt is inserted. Paper is used as a buffer, furnishing an elastic medium between the bolt and the porcelain ring, and cement is placed between the ring and the cap to distribute the pressure.

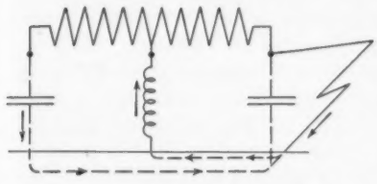


The claims for this insulator are long life because of prevention of breakages due to different expansion coefficients of porcelain, cement and iron; a large unit capacity, resulting in better voltage distribution on a string of insulators, and a higher breakdown voltage due to better field distribution.

Cables are used more in Europe than in the United States. The limits usually placed on cables are 80,000 volts for single-conductor and 40,000 volts for multi-conductor cable. Cables rated at 30,000 volts, three-phase, are quite common, and 50,000-volt, three-phase cables have been manufactured. At high voltages, however, the thickness of the insulation required makes the cable hard to handle and expensive. Besides, dielectric losses are great. Measurements on a 165-mile cable system of three-phase conductors, each of 250,000 circ.mils, showed a dielectric loss of 113 kw. at 30,000 volts.

Great claims are made for cable protective systems, of which the A.E.G. and Siemens-Schuckert both have their systems. These will be briefly described.

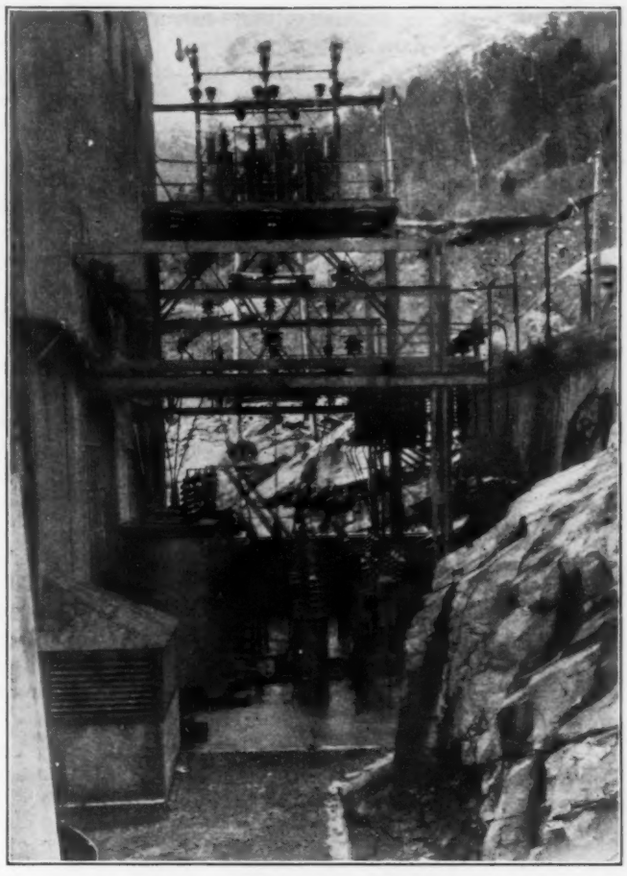
In the Pfannkuch system of the A.E.G. the individual conductors in the outer layer of the cable are purposely rather poorly insulated from each other and from the central core by means of paper. The odd and even conductors are connected together respectively so that there are really three paths through the cable. By means of a special differential transformer at each end the potential of the one path is raised slightly above that of the core and the other is diminished to a like degree. This potential is about 20 volts to 50 volts. In case of mechanical injury or injuries affecting the electrical qualities of the cable the slight insulation between the neighboring conductors is broken down, more or less, and the potentials of the different paths are varied. Through the differential transformer and connected relay the circuit breaker acts instantly. No pilot wire is needed; the action is independent of the direction of the current and external currents, and the circuit is broken while the damage to the cable is being done and really before the short circuit or ground is fully a reality. The only disadvantage claimed by the manufacturers is that a specially constructed cable is necessary and therefore cannot be applied to systems where the cable is already in.



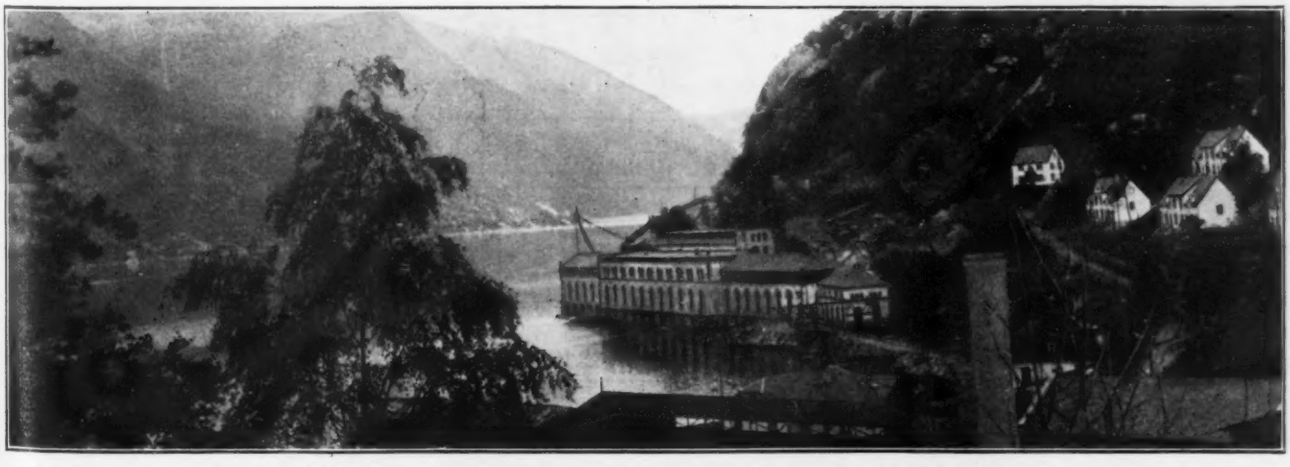
THE PETERSEN COIL INTERPOSES A LOCAL RESONATE CIRCUIT IN THE GROUND CONNECTION

The Lypro system of Siemens-Schuckert is similar to the one just described with the slight exception that there are only two paths through the cable instead of three and that the voltage difference is 120 volts.

A discussion of protection against high voltages would require an article in itself, and hence the matter can only be briefly summarized here. For a long time the European engineer has felt at a loss in regard to high-voltage protection. He has tried countless types of apparatus—horn gaps and multigaps with all their modifications, condensers, water-drip apparatus and other things, but they have all, with the possible exception of horn gaps and series resistance, fallen into disuse and installations have been disconnected. Electrolytic arresters are only used in a few American installations and oxide-film arresters are practically unheard of. Within the past few years, however, a device has been found which Europeans believe is a cure for many of their troubles—the Petersen coil and its modifications. It has been welcomed enthusiastically and is being installed in all the new stations and many of the old ones. As an instance of its popularity it may be recounted that Professor Petersen, while visiting a large hydro-electric power station in Norway where a large number of different types of protection apparatus were installed, including electrolytic equipment, told them to throw it all in the scrap heap and install a Petersen coil—and they did it! It is to be hoped, how-



AN OUTDOOR INSTALLATION AT THE BJOLVO STATION OPERATES SATISFACTORILY, ALTHOUGH OFTEN PARTIALLY COVERED WITH SNOW



A 140,000-HP. DEVELOPMENT AT SORFJORDEN HAS FIFTEEN PELTON UNITS

ever, that real data furnishes the evidence in favor of the coil, but such data was not found.

Dangerous voltages may arise from an innumerable number of causes, but the majority fall into three classes—switching phenomena, intermittent grounds and atmospheric disturbances.

It is recommended that the reactance coils composing the Petersen coils should be installed whenever the current due to ground on the high-tension side is in the neighborhood of 5 amp. or more. In computing this current it is considered that 100 km. of transmission line operated at 10,000 volts and 50 cycles has a current of about 2.5 amp. without ground wire and one of 3 amp. with ground wire. For cable systems the current ranges from 40 amp. to 100 amp., depending on cross-section and voltage. The coil is said to be most effective when the frequency of the oscillatory circuit formed by the capacity to earth of the whole system and the reactance of the coil is equal to the normal transmission frequency.

As the A.E.G. manufactures the Petersen coil, other manufacturing companies have their special coil. The Siemens-Schuckert is of the transformer type with the neutral of the star-connected primary grounded and a variable reactance introduced in the delta-connected secondary. It was admitted by a Siemens-Schuckert engineer that there was no question that the Petersen coil was an excellent device for handling voltages up to 50,000, but he was afraid of resonance disturbances above that. The coil manufactured by Brown-Boveri is practically the same as the Petersen coil with the exception that it is calculated for 25 per cent dissonance.

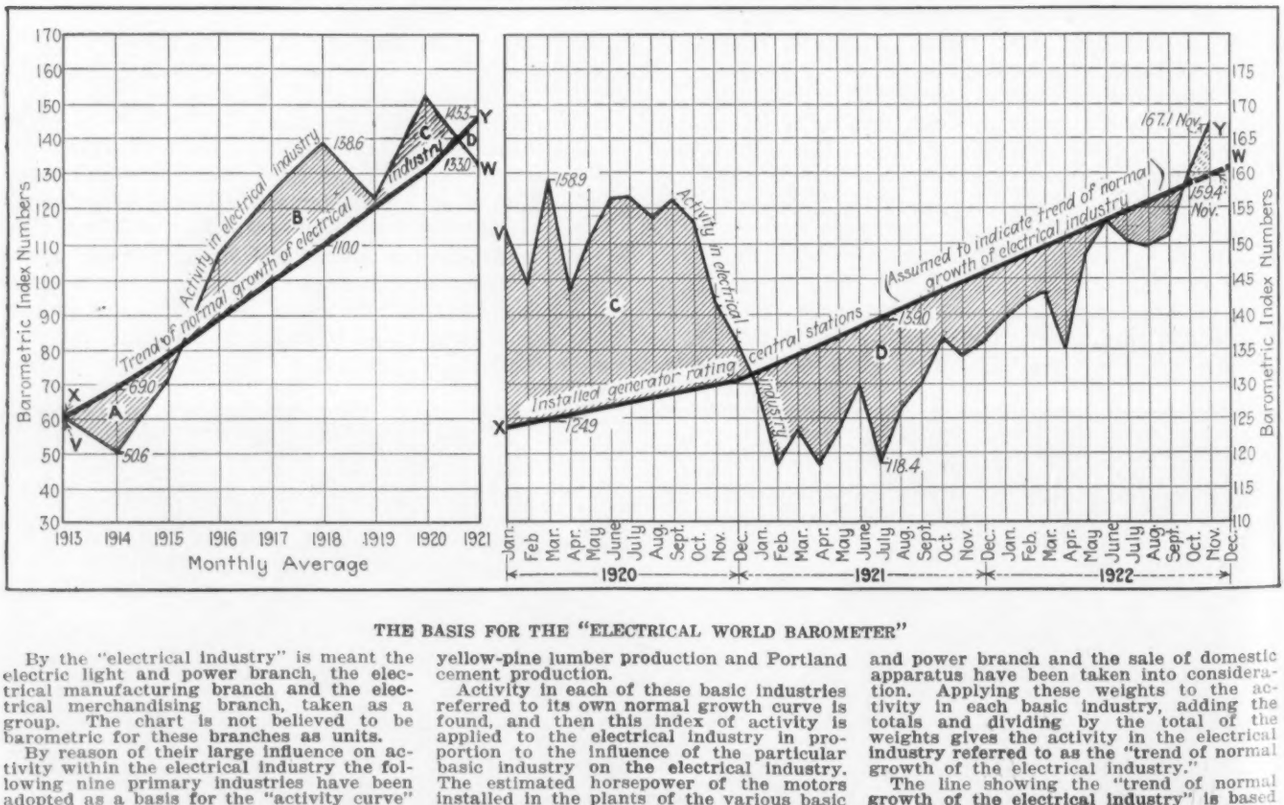
Further Progress in Production

INDEX figures upon which the "ELECTRICAL WORLD Barometer of Business Conditions in the Electrical Industry" is based indicate that November activity within the industry was materially in excess of that experienced during October. The largest consumption of cotton since 1917 and further high records since 1920 in the output of pig iron, steel ingots, coke, zinc, locomotives and leather emphasized the sustained and basic character of industrial production during November. The usual seasonal decline of building construction in that month failed to materialize.

The "ELECTRICAL WORLD Barometer" indicates that in the month of November business conditions in the electrical industry, taken as a whole, continued to show the monthly improvement which started in September. The basic data indicate an increase of 6.7 points on the Barometer scale as compared with October. The electrical industry as a whole was operating at 7.7 points or per cent above what would have been the point of seasonal demand if growth in the industry had been normal. In October it was operating at 2.4 points or per cent above the point of normal demand.

The returns for November continued to point clearly to the probability that a long season of unusual activity is just opening up for the electrical industry. In many sections collections are reported still generally slow, and other retarding influences from the recent depression are holding back much of the possible progress. But the business is undoubtedly to be had, and its development awaits only the toning down of these retarding influences.

ELECTRICAL WORLD BAROMETER OF ELECTRICAL BUSINESS CONDITIONS



THE BASIS FOR THE "ELECTRICAL WORLD BAROMETER"

By the "electrical industry" is meant the electric light and power branch, the electrical manufacturing branch and the electrical merchandising branch, taken as a group. The chart is not believed to be barometric for these branches as units.

By reason of their large influence on activity within the electrical industry the following nine primary industries have been adopted as a basis for the "activity curve" of the electrical industry: Active cotton spindles, pig-iron production, bituminous-coal production, copper production, newsprint-paper production, passenger automobile production, truck automobile production, yellow-pine lumber production and Portland cement production.

Activity in each of these basic industries referred to its own normal growth curve is found, and then this index of activity is applied to the electrical industry in proportion to the influence of the particular basic industry on the electrical industry. The estimated horsepower of the motors installed in the plants of the various basic industries has been taken as a basis for weighting the industries in their influence on the electrical industry. In weighting the lumber and Portland cement industries the large domestic load of the electric light and power branch and the sale of domestic apparatus have been taken into consideration. Applying these weights to the activity in each basic industry, adding the totals and dividing by the total of the weights gives the activity in the electrical industry referred to as the "trend of normal growth of the electrical industry."

The line showing the "trend of normal growth of the electrical industry" is based upon the rating of the active installed generators of the central stations of the country. Further details concerning the development of the "Barometer" will be gladly furnished upon request.

Power Factor as It Affects the Consumer

Causes of Poor Power Factor—Remedial Measures, Including Rearrangement of Motors and Use of Synchronous Apparatus, Phase Advancers and Condensers—Economic Factors Which Should Be Considered

By L. J. MURPHY
General Engineer Westinghouse Electric & Manufacturing Company

INDUCTION motors, particularly when underloaded, cause a poor power factor on a system, and when a large part of the load of a central station consists of induction motors naturally the power factor will not be very high. For a long time a poor power factor was considered a necessary evil and little or nothing was done toward correcting it.

During the recent war, when production was at its highest, the central stations began to realize that their generators were being worked above their rated capacity while their prime movers were considerably underloaded, naturally resulting in poor economy of operation. As their load increased they also began to realize that it would be necessary to take action to overcome this evil, particularly since it meant the installation of additional costly electrical equipment on their part, which would be unnecessary if their customers had maintained a reasonable power factor. To the central stations poor power factor meant increased generating capacity, increased excitation losses, larger line losses and a more expensive distribution system than was really necessary. Obviously, a poor power factor was something about which there was cause for worry and concerning which there was justification in the contention that the consumer should bear some portion of the expense.

To accomplish this end the central stations, as a rule, imposed a penalty upon plants for their poor power factor. This penalty in the majority of cases was based upon the maximum demand and a power factor of 80 per cent. For all power factors below 80 per cent the demand charge was increased in inverse proportion to the power factor; that is, if the power factor were 60 per cent and the maximum demand was 1,000 kw., then the maximum demand upon which the demand charge would be based would be $80 \div 60 \times 1{,}000$, or 1,333 kw. In some cases a bonus was allowed the customer for power factors above 80 per cent, and the same general scheme of calculating the demand was used in this case.

With this system of charging the burden of the expense caused by a poor power factor rightfully fell upon the shoulders of the consumer whose power factor was low. In very few cases the energy rates were decreased if the consumer's power factor was good, but in most cases only the demand charge was affected.

The first question naturally asked by the consumer of power is: What are the causes of a poor power factor and how can it be corrected? The chief causes of poor power factor where induction motors are used are, first, overmotoring the machine; second, the use of low-speed induction motors, and, third, the use of individual motors on machines where the motors run continuously but the load on the machine is of an intermittent nature, as, for instance, punch presses or shears.

Overmotoring is by far the worst offender. It is a well-known fact that induction motors when operating at light loads, as is the case with an overmotored machine, have poor power factors, and in order that the plant may have the highest power factor obtainable, it is essential that the motors be operated as near to full load as possible. When a new plant is installed it is quite often the case that very little is known regarding the horsepower requirements of the various machines, and it is left to the manufacturer of the machine or to the power company's solicitor to determine the proper size and type of induction motor to be used. The machine manufacturer knows the horsepower requirements of his product, but feels that in order to play safe and to take care of any emergencies he should specify a motor with a horsepower rating perhaps 10 or 20 per cent in excess of that actually required. His estimated figure usually is high enough to take care of the most unfavorable condition to be found, and therefore will easily suffice for plants where the operation is not so severe. The power company's solicitor and the motor salesman, in order to insure that the motor will not be overloaded, usually figure on a reasonable factor of safety, and if the power requirements of the machine are less than expected, owing to conditions in the process of manufacture, then the natural result is overmotoring. Where a motor is to replace one already installed overmotoring seldom occurs as the actual power requirements of the machine can be measured. Both the power companies and the electrical manufacturers have done good work in aiding the power consumer in the proper selection of motors.

Low Speed Induction Motors Draw Large Magnetizing Current

An induction motor having a large number of poles—i.e., a low-speed motor—requires considerably more magnetizing current than an induction motor having a small number of poles. The magnetizing current determines to a large extent the power factor of the motor, and if it can be kept low, the power factor will naturally be increased. Obviously, then, it should be the desire of the power consumer to utilize high-speed motors in all cases where possible in order to keep this magnetizing current down to a minimum.

There has been much discussion as to whether individual motor drive or group drive is the better method for operating a number of similar machines. Both methods have their advantages, but as far as power factor is concerned the group drive generally gives the better results, inasmuch as a higher load factor is maintained on the motor. Individual drive, however, reduces the losses caused by belting and line shafting, giving a lower energy consumption.

Cases can be cited where by rearranging the motors in the plant the power factor has been increased from

5 to 10 per cent. This procedure, however, usually entails the elimination of several larger-size motors and the purchase of a few smaller motors to take their places. Before installing any power-factor-correcting features this procedure for bettering power-factor conditions should be thoroughly investigated.

Aside from rearranging the motors in a plant, power-factor correction can be obtained by the use of synchronous motors, phase advancers, static condensers and synchronous condensers. Some of the relative merits of each will be given below.

The design and construction of the synchronous motor is such that it is possible for it to be built for very low speeds with good performance at a lower cost than an induction motor of the same rating and speed.

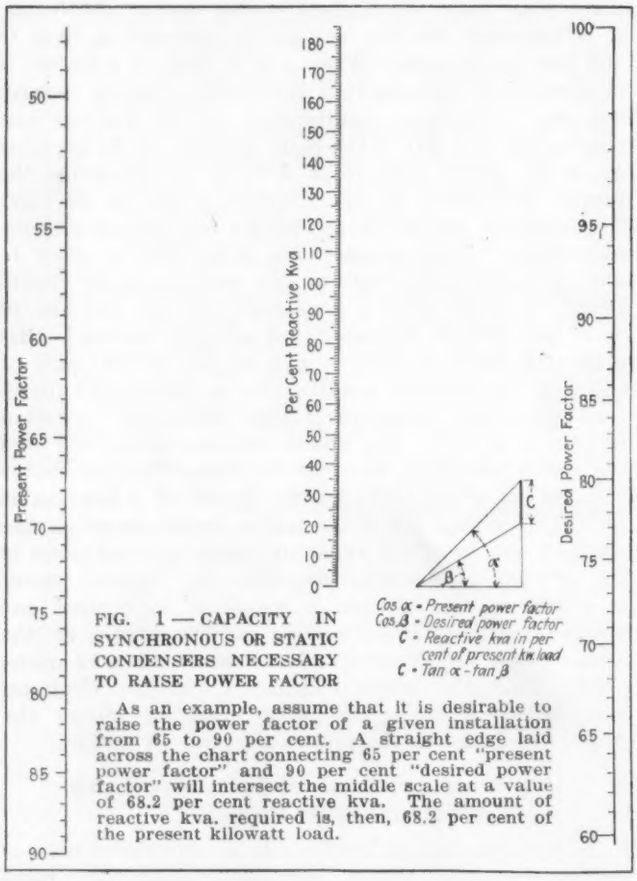

Present Power Factor
Per Cent Reactive Kva.
Desired Power Factor
Cos α = Present power factor
Cos β = Desired power factor
C = Reactive kva in per cent of present kw. load
C = Tan α - tan β

FIG. 1 — CAPACITY IN SYNCHRONOUS OR STATIC CONDENSERS NECESSARY TO RAISE POWER FACTOR

As an example, assume that it is desirable to raise the power factor of a given installation from 65 to 90 per cent. A straight edge laid across the chart connecting 65 per cent "present power factor" and 90 per cent "desired power factor" will intersect the middle scale at a value of 68.2 per cent reactive kva. The amount of reactive kva. required is, then, 68.2 per cent of the present kilowatt load.

It is applicable as a directly connected machine to air compressors, ammonia compressors, fans and centrifugal pumps, and can be used with clutches on any other form of drive on which induction motors are now supplied. The synchronous motor can be designed to operate at a leading power factor, thereby supplying a considerable corrective effect to the rest of the plant, but in cases where the synchronous motor load is almost the entire load a motor designed for 100 per cent power factor only is required.

While a synchronous motor has larger losses than some other forms of power-factor-correcting devices, yet the greater portion of its losses can be charged to the losses which would be found in the induction motor ordinarily used on the application. This feature is illustrated in the accompanying table where the losses which could really be attributed to power-factor correction amounted to only 1 kw. In some cases, particularly with very low-speed machines, it might work out that the losses in the synchronous motor will be less than in the induction motor. If a synchronous motor is replacing an induction motor the investment charges against power-factor correction can be reduced by the value of the induction motor which the synchronous machine is replacing. Moreover, no extra operating charges are incurred, since the same man who previously operated the induction motor can now take care of the synchronous motor.

A phase advancer can be applied only to wound-rotor motors of suitable characteristics. It is connected in the secondary circuit of the wound-rotor motor and operates to supply the magnetizing current for that particular motor, thereby making the motor practically a 100 per cent power-factor machine over the usual

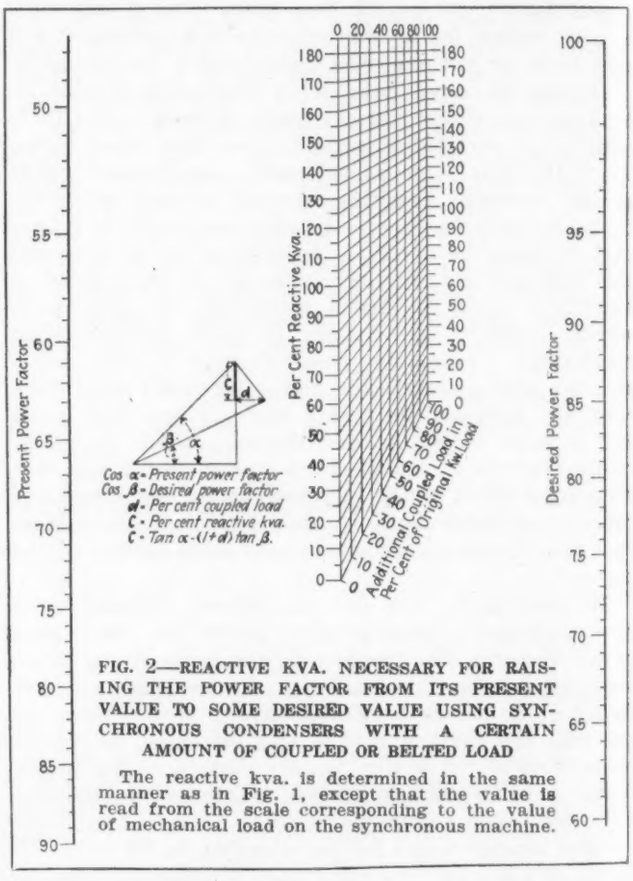

Present Power Factor
Per Cent Reactive Kva.
Desired Power Factor
Additional Coupled Load in Per Cent of Original kw. Load
Cos α = Present power factor
Cos β = Desired power factor
d = Per cent coupled load
C = Per cent reactive kva.
C = Tan α - (1+d) tan β.

FIG. 2—REACTIVE KVA. NECESSARY FOR RAISING THE POWER FACTOR FROM ITS PRESENT VALUE TO SOME DESIRED VALUE USING SYNCHRONOUS CONDENSERS WITH A CERTAIN AMOUNT OF COUPLED OR BELTED LOAD

The reactive kva. is determined in the same manner as in Fig. 1, except that the value is read from the scale corresponding to the value of mechanical load on the synchronous machine.

operating range of load. In so doing it increases the current in the rotor of the motor, and if the rotor has not been liberally designed, the phase advancer cannot be applied. An examination of the accompanying curve shows the action of a phase advancer on the performance of a 150-hp. slip-ring-type motor.

During the last few years a number of electrical manufacturers have made considerable progress in developing a static condenser for power-factor correction. This type of corrective device requires no special foundation and little or no attendance, and where the service voltage is such that no transformer is required to furnish the proper voltage to the condenser the losses in it are negligible, being less than one-half of 1 per cent. It cannot, however, be readily adjusted to meet various conditions of loading in the plant, since the condenser effect is constant.

Its initial cost is somewhat higher than other forms of power-factor-correcting devices. The losses in static

condenser equipments complete with transformers where required vary from 2½ to 3 per cent. Owing to the fact that static condensers consist of a large number of small units, the price is naturally a direct function of the kva. required, and for this reason a static condenser does not compare favorably with other forms of power-factor correction where large corrective effects are involved.

The synchronous condenser is practically the same in construction as the synchronous motor, except that its mechanical parts are not designed to transmit any mechanical load. Its losses vary from about 11 per cent for the small commercial size, namely, 100 kva., down to 4 per cent for the larger sizes, namely, 1,500 kva. The price per kva. is not constant as is the case with static condensers, but decreases with the size, so that in the larger sizes the synchronous condenser is really the more desirable.

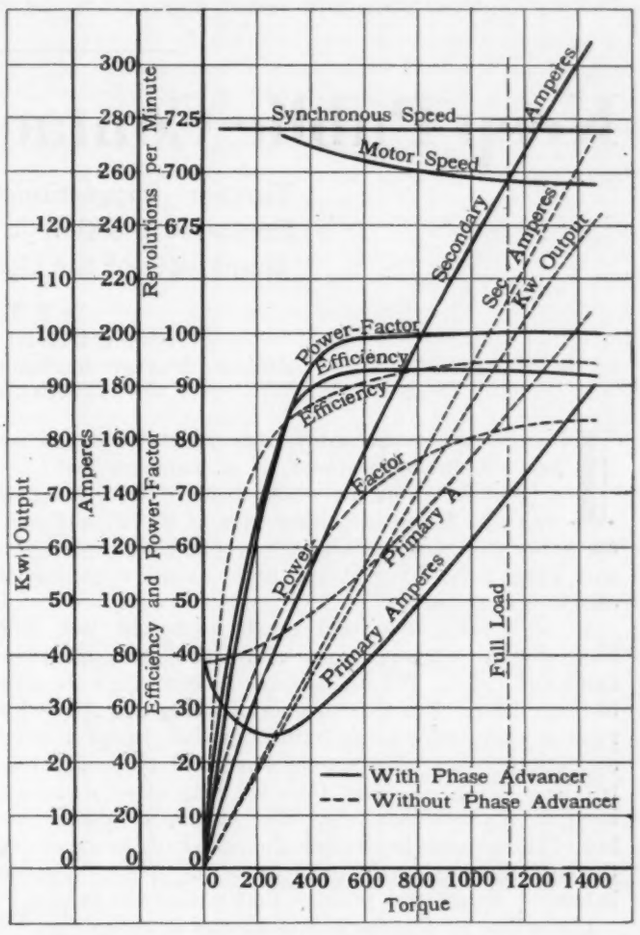
All Angles Should Be Investigated

The power consumer, in determining whether power-factor-corrective devices should be installed, should investigate the situation from all angles, particularly in regard to the aspect of economy. If it happens that he is being penalized several hundred dollars a month on account of his poor power factor, he is invariably under the impression that if he corrects his power factor he can save the greater portion of this penalty. Such, however, is not always the case, for the power-factor-correcting devices require a certain amount of power and the cost of this power is liable to be as great as or even much greater than the penalty. The cost of this additional power is not readily discernible in the power bill, and the consumer is under the impression that the amount saved on his maximum-demand charge is clear profit. However, the power companies have usually investigated this feature and offer a premium for good power factor which is sufficient to make the installation profitable to all concerned. Investigation of the power rates and the cost of power-factor correction by the consumer may disclose the fact that while a saving could be accomplished by correcting this power factor to unity, yet a still greater saving could be obtained by correcting only up to 90 per cent.

In comparing the economy of the different forms of power-factor correction, suppose, as an example, that a plant is taken which has an average load of 300 kw. at 70 per cent power factor and it is desired to increase the power factor to 85 per cent. To bring about this increase will require 120 reactive kva. Suppose also that in the above plant there is operating a 200-hp. low-speed slip-ring-type motor driving an ammonia compressor which operating at three-quarters load has a power factor of 70 per cent. With these conditions any of the various means for correcting power factor could be employed, and it remains to determine which one will work out to the maximum benefit of the purchaser. Providing the characteristics of the slip-ring motor are satisfactory a phase advancer can be applied. A synchronous motor designed for 100 per cent power factor operation, if used to replace the induction motor, will eliminate the 120 reactive .kva drawn by the induction motor, and bring the power factor of the plant up to the desired figure. The other corrective devices can be used in any plant.

PRINCIPAL ITEMS OF EXPENSE IF A STATIC CONDENSER, PHASE ADVANCER, SYNCHRONOUS MOTOR OR SYNCHRONOUS CONDENSER IS EMPLOYED

Item	Static Condenser—With Trans.	Static Condenser—Without Trans.	Phase Advancer	Synch. Motor	Synch. Condenser
Initial cost	$3,600	$2,600	$800	$3,500	$2,600
Cost of installation	200	200	200	800	800
Value of equipment replaced	.....	.....	.....	800	.....
Investment chargeable to power-factor correction	3,860	2,800	1,000	3,500	3,400
Losses in kw.	3.6	.6	2.0	12.0	11.0
Losses in equipment replaced	.....	.....	.....	11	.....
Losses chargeable to power factor correction	3.6	.6	2.0	1.0	11.0
Cost of power per year (7,200 hr.) at 1½ c./kw.-hr.	388	65	216	108	1,188
Interest and depreciation 12 per cent	456	336	120	420	408
Attendance and upkeep chargeable to power-factor correction	.....	.....	20	.....	150
Total cost per year	$844	$401	$356	$528	$1,746



PERFORMANCE CURVES OF MACHINE WITH AND WITHOUT USE OF PHASE ADVANCER

An examination of the accompanying table shows that under the conditions assumed the phase advancer is the most desirable proposition, with the static condenser without transformer showing up almost as well. However, it quite often happens that the slip-ring motor is not adaptable to the application of a phase advancer and the voltage of the plant is such that a static condenser cannot be applied without the use of transformers. If such were the case, the synchronous motor replacing the slip-ring motor would undoubtedly be the best proposition to consider. Obviously, then, a power-factor-correcting device which would be satisfactory in one plant would not work out advantageously in another plant. The impression might be obtained from the table that a synchronous condenser could never be applied as a means of correcting power factor, but if a plant which requires a rather large cor-

rective effect, say 1,000 kva., is taken as an example and all the machines are small so that synchronous motors could not be used economically, then the synchronous condenser would compare favorably with the static.

The three main points then to be considered in selecting the proper power-factor-correcting device are as follows: First, the power losses in the corrective device; second, the interest and depreciation of the investment; third, increased operating expense.

In order to assist the consumer of power who is not thoroughly acquainted with vector diagrams in determining the proper size of corrective apparatus, two charts are presented.

The power consumer will quite often find that where previous to correcting his power factor he was unable to install any additional load on account of the fact that his power transformers were overloaded he can now make a considerable increase in his load without exceeding the carrying capacity of his transformer.

The charts (Figs. 1 and 2) were prepared by W. E. Douglass of the Westinghouse Electric & Manufacturing Company.

Keep Public Contacts from Sparking—II

Further Suggestions for Avoiding Possible Points of Friction in the Daily Contact of the Employees of the Utility with the Community

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IN A recent article in the ELECTRICAL WORLD on improving public relations H. A. Lemmon said:

"The secret of the whole thing, if it be a secret, is to be found in taking care of the little things, the minor points of contact with people. Very small keys will open very large doors both in an organization and in a community."

It is equally true that small keys will lock shut large doors. Through some doors can come consumer faith and trust. We should have on our rings the keys to open these. From other doors, if they are allowed to remain open, may issue influences that breed distrust and antagonism. We should have and know the keys to these doors in order that we may close them and keep them closed securely. The locking or the unlocking of these doors lies within the power of the executive, through the setting, in little ways like those suggested below, of thoughtful policies that please the public.

Operation of Company Trucks and Automobiles.—It may seem far-fetched to connect the operation of cars and trucks with public relations. The fact remains that there is an opportunity, through proper education of those driving such company vehicles, to lock one door of complaint and criticism.

If you have ever driven your own car behind a large oil company's tank truck, which had the owner's name emblazoned on it in large letters, and the truck hogged the road and forced you to the ditch or prevented your passing it, you must admit that you did not feel particularly like patronizing one of that company's filling stations when you ran out of gas on the road. Neither is your wife partial to a grocer whose truck, driven without regard to pedestrians, splashes her clothes at some street crossing. Again, you cannot be too favorably impressed with the management of a company whose trucks, recklessly driven by your house, endanger the lives of your children. Suffice it to say that cars and trucks of central stations should be driven with due regard to traffic laws and the rights of pedestrians.

Moving Poles.—Some city franchises practically enable the central-station company always to charge for moving poles if it sees fit to do so. To exercise this right is probably unwise. It emphasizes first the existence of poles on the streets, which may cause an agitation for underground service. Secondly, it places the company in a position of insisting on its rights in matters of small importance. Rights are nice things to possess, but it is not always wise to enforce them.

Extension of Service.—A liberal and equitable policy in extending service, particularly within and adjacent to city limits, makes friends for a central-station company. Frequently political considerations require unusual expenditures of this nature. If possible, it is better to meet them gracefully and quickly, because usually they must be made eventually.

Where a particular extension is to be refused, a close study should be made before it is refused, for sometimes dollars seemingly unwisely spent may be returned tenfold. People today have so many affiliations socially and in a business way that the pigeons may come home to roost any time. The management should keep a close check on extensions from the psychological side as well as the economic side.

This may seem too liberal a policy to pursue and is not to be taken as always applying to what are known as rural extensions. When, as stated, it applies to the policy prevailing in and around a city or town, there is not much to be lost, because cities and towns are growing so rapidly that what today may be an unwise investment may a week or a month or a year from now prove decidedly profitable.

Cut-outs for Non-Payment.—The uncollectible accounts of lighting companies have usually been held at a low figure, because in each case there has always been hanging over the customer, like the sword of Damocles, the possibility of being cut out for non-payment. It has been perfectly proper and just that the company should have this privilege. At the same time it is a power which should be exercised judiciously, and in general it has so been exercised. On the other hand, the routine and manner of making cut-outs for non-payment is worthy of considerable study.

In the first place, regardless of how the collection department may look upon a customer who is affected

with chronic delay in payment of his bills, the fact is that once he does pay up in any given instance he is then a customer of good standing and entitled to every consideration—at least until his next offense.

A rather usual routine in handling such cut-outs is for the collection department to notify the order clerk to issue a cut-out, which cut-out order is then either sent to the operating department or to certain employees who are charged with collecting from customers. They either collect the bill or disconnect the service.

There is always the possibility that between the time when the order is issued and the time when the employee arrives on the customer's premises prepared to execute it the customer may have called at the office and made either a full payment or a partial payment satisfactory to the collection department. The cashier taking this payment may be the only person having full knowledge that the payment has been made. It therefore becomes necessary that before any employee actually disconnects service to any customer he should first communicate with the collection department by telephone and ascertain whether the account has been paid. This also requires that the cashier keep a record of such payments so that the information may be given promptly.

This co-operative effort will obviate the very disconcerting situation of a customer's service being disconnected after he has actually paid up. Usually such a customer is in a rather disgruntled frame of mind at being prodded to pay his bill, and if after finally paying he then finds that his service after all has been disconnected, his perturbation is naturally much increased. If this situation arises out of the company's routine methods, the customer is somewhat justified in his attitude.

Interruptions Cause Good Will

Good Will from Emergencies and Interruptions to Service.—It sometimes seems a paradox that out of serious interruptions to service can come good will. Nevertheless, such is the case, and this will be attested by no mean number of public service companies which have come through trying times as the result of severe storms or fire. When these emergencies arise and service is cut off either completely or to a large portion of the customers, there immediately comes the opportunity to do favors for individuals or for large sections of the public. During such periods the "contact" employees of any company should be led to feel that their duties are no less important than those of the operating men, who are charged with the specific duty of effecting repairs, rehabilitating parts of plants which are destroyed, and in general performing those functions which appeal to the layman as more spectacular than sitting by a telephone and receiving requests for service and endeavoring to have them executed.

The public in general either understands the forces beyond the control of a public service company which bring about catastrophes and service interruptions or it can be easily made to understand the situation by proper publicity during or immediately after the interruptions occur. It is surprising to note what allowances the public seems to make in such cases once it realizes the facts. When the entire organization affected bends its energies day and night to resume service there is no question that the customers appreciate and are grateful for what is done for them. There may be some who take the efforts of the company's employees as a matter of course and feel that it is no more than they should expect. These, however, will be found to be in the minority.

Therefore, "contact" employees, and all of those in an organization charged with improving public relations, should look upon every catastrophe affecting service as an opportunity to improve good will. When this is done rarely will the company come out of such a period of stress without an increased number of friends.

Supervision.—Lack of proper supervision, resulting in men loafing on outside jobs, naturally costs a company good money. It is then paying for something it does not get. The dollars and cents loss, however, may be small compared to the loss in prestige the company suffers through the public getting the idea that in handling work its officials are inefficient.

For example, picture the effect on a prospective customer who, on account of his remote location, is obliged to pay a portion of the cost of running an electric line or laying a gas main to his premises if the construction crew sent is too large or if the foreman goes away and the men "take it easy" during his absence. The prospective customer naturally feels that he is being called upon to pay for some or all of this waste time. His opinion of the company will not be of the best.

Labor Affects Public Relations

Just so, the manner in which the ground man digs holes or the laborer ditches has a bearing on public sentiment by no means unimportant. No company can afford to stand before the public as inefficient. When we contend that we must receive a fair return on our investment, the public in turn may well insist that the work of creating that investment be done as efficiently as possible.

It is to be noted that not only our customers of today are our critics, but in the future as the ownership of our securities is spread more thinly among the public, including our customers, these owners of securities will naturally become more critical of our work, because in their minds they will feel that it is their funds we are spending.

The Effect of Method of Compensation for Salesmen.—There are today probably two schools of thought as regards the most effective method of paying salesmen. One believes in a straight salary basis, the other in a salary plus commission basis. The former policy may not produce so large a volume of sales measured in dollars and cents, or in any other unit, but it does tend toward better satisfied consumers.

It is easier to imbue a straight-salaried salesman with the spirit of service. The introduction of a commission or bonus puts sales upon a competitive basis, where the consumer's viewpoint is too frequently ignored. Two satisfied consumers are better assets than three dissatisfied consumers, or even than two who are content plus one who has cause for complaint due to misrepresentations made at time of sale. Grouchiness and the spirit of complaint are just as contagious as happiness. Misery not only likes company, but many times company courts misery.

Particularly liable to strain public relations are appliance campaigns by outside organizations. The salesmen employed are generally guided solely by their desire to make the biggest day's income. They have no constant interest in the local company. They are not a

part of its organization and frequently are only temporary employees of the outside organization handling the campaign. If such organizations are to sell in any territory, it is better that they do it under their own name. The electric company may well steer clear of such entangling alliances.

Team Work in the Organization.—One manager of a large central-station company stated to the writer recently that in fully 75 per cent of all of the cases where the consumer complained the company was in some way at fault. The importance of this statement is increased when it is realized that the company in question has a most liberal service policy and that all down through the organization there exists to a high degree the "spirit of service."

Undoubtedly fault on the part of the company may be due to two things, the personal equation of the individual employee or lack of team work and even friction within the organization. Errors due to the personal equation can be largely reduced by the proper choice and training of personnel.

Lack of team work is more difficult to remedy. Good men individually may not work well as a team. In our dealings with our consumers there are so many interdepartmental relations that opportunities for slips are many. Then, too, the aims of certain departments naturally tend toward friction with other departments unless constant care and supervision are exercised. The sales department chafes at the restraint of the collection department, which many times is called upon to place its "N.G." on certain new business which the sales department may have developed only after strenuous effort. The operating departments are frequently taken to task by the sales department because the former fail to make connections and set meters quickly enough to satisfy the new consumers which the latter has secured.

These are but two of many possible causes of internal friction. The remedy lies in educating the respective departments to a reality of the trials and tribulations of the other departments. "Get-together" meetings help to iron out these difficulties. The interchanging of employees between departments for a short period, as, for example, the putting of salesmen into the meter and service departments, and vice versa, helps the employees of each department to understand the viewpoint of the other departments with which they have relations.

This clearer understanding reached, then the organization is better able to function as a whole and by the better service rendered lock the door against a great mass of justified complaints from consumers. A general prescription for the difficulty may perhaps be contained in the motto, "Don't sell—serve." The commitment of all departments, and particularly the sales department, to this policy will give rise to a different viewpoint all down through the organization and among the various divisions.

Local Purchasing by Central Stations.—Local purchasing has been discussed from certain angles from time to time. Its value is further enhanced by the central-station company being thus better able to enlist the aid of local dealers and manufacturers in furthering legitimate company policies in times of stress as well as improving conditions in times of peace. Local merchants and manufacturers have really a greater incentive to support the company than many consumers who own company securities. Many of the former usually get more dollars in profits on merchandise sold than the latter receive in dividends. Where a man's or a business firm's dollars come from, there lies his or its interests.

Donations and Contributions.—The tendency is for the demands of charity to increase. Where commission regulation prohibits the company from making such contributions, except for certain purposes, the number of disbursements is naturally less. However, such donations and contributions are prominent more because of their number than because of any actual large percentage of gross income so disbursed.

To be sure, the central station is in a way the trustee of funds intrusted to it by the public for use in rendering a certain public service. But this trusteeship many times may best be exercised by being liberal in contributing to local activities, because the favorable sentiment created reacts to the company's benefit and hence to the good of all in the community. Whatever benefits the company does actually benefit the community, and hence its consumers, and the converse is equally true about injuries.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Opposition Test of Polyphase Meters

To the Editors of the ELECTRICAL WORLD:

In the article appearing on page 1394 of the Dec. 23 issue of ELECTRICAL WORLD entitled "Testing of Polyphase-Type Watt-hour Meters" D. C. Hoffman refers to the "opposition" test for balance in a polyphase meter. Personally, I have not favored this method for the reason that with potential applied in the normal way on both elements (one current reversed to give the opposition) the friction compensation still acts in the same forward direction for both elements. If the torque adjustment is then made, it will result in one element being slower than the other by twice the amount of the friction compensation per element. This perhaps is not enough to condemn the practice for ordinary field tests.

In another part of the article Mr. Hoffman makes no reference to the phase relation between potential of one phase and current from another phase for the purpose of making the registration correct at 50 per cent power factor. If the lag resistance is precisely adjusted, the meter then will be correct for both lead and lag. If not, the error for the other condition will be twice as much as the error remaining for the condition (lead or lag) used in making the adjustment.

I am not in agreement with the proposed use of a phantom load. Resistance in the primary may regulate current magnitude well enough, but it will throw the resultant power factor wholly into doubt. The proper place for resistance to regulate current magnitude and preserve some semblance of unity power factor is in the low-voltage secondary circuit of the phantom load. Apart from the regulation of current magnitude, there should be enough voltage on the secondary circuit to permit the insertion in that circuit of enough resistance, even at maximum rating of the load box, to insure that the secondary current is approximately in phase with

the primary voltage; otherwise the power factor will be appreciably less than unity at times when unity is desired and seriously less than 50 per cent when that figure is desired.

A. E. KNOWLTON,
Assistant Professor of Electrical Engineering.
Sheffield Scientific School, Yale University,
New Haven, Conn.

Testing of Polyphase-Type Watt-Hour Meters

To the Editors of the ELECTRICAL WORLD:

In the ELECTRICAL WORLD for Dec. 23, page 1394, Dan C. Hoffman has an enlightening article on the practical testing of polyphase meters. However, there is a slight error in his "hook-up" which I would like to correct.

When the two elements of the meter are connected in series, whether for balance or regular test, the lower shunt coil should be grounded to the upper series coil instead of to the lower. In Mr. Hoffman's diagram the losses of the lower shunt coil will register on the upper series element, and, although the error is slight on full load, it is very noticeable on light load, especially with the smaller sizes of meters.

METER TESTER.
Central Illinois Public Service Company,
Beardstown, Ill.

Electric Drive for Paper Machines

To the Editors of the ELECTRICAL WORLD:

In your issue of Nov. 11 there is an article on sectional electric drive for paper machines in which the following statement is made: "The war gave impetus to this development so that three distinct systems are now available—Westinghouse and General Electric in this country and the Harland system in Canada." This statement may lead to a misconception.

We wish to say that the Harland drive is available in the United States as well as in Canada. Arrangements have been made for its manufacture in the United States, and the sales representation is in the hands of Thomas H. Savery, 1718 Republic Building, Chicago, who is well known in the paper trade.

It may also be of interest to your readers to know that the first Harland Electric Drive was installed and put into operation in the year 1913 and has been running satisfactorily ever since. The war delayed its development owing to the fact that the works of the Harland Engineering Company were fully occupied with war service. Immediately after the war, however, the development of this drive was actively prosecuted, and the apparatus has met with a very large degree of success and given complete satisfaction to all who have installed it.

R. N. NORRIS,
Managing Director.
Harland Engineering Company of Canada, Ltd.,
Montreal, Que.

New Zealand Leads in Proportion of Savings-Bank Depositors

To the Editors of the ELECTRICAL WORLD:

I noticed in a recent issue of your paper that you quite rightly asserted that the number of savings-bank depositors is a measure of the industrial stability of a country. You followed this by pointing out that the number of accounts in the United States is 100 per 1,000 persons, in France 346 per 1,000 and in England 302 per 1,000. May I point out that the proportion of post office savings bank depositors in New Zealand is 518 in every thousand?

H. A. HUGGINS,
Controller of Savings Banks and Accounts.
Wellington, New Zealand.

Laminated-Frame Arc-Welding Generator

To the Editors of the ELECTRICAL WORLD:

In the Oct. 1 issue of the ELECTRICAL WORLD there appeared a discussion by Pliny P. Pipes under the caption "Laminated-Frame Arc-Welding Generators." While we agree with many of the points brought out in Mr. Pipes' discussion, we do not believe that the advantages set forth for the laminated-frame construction really warrant this type of machine in preference to solid-frame types of welding generators.

In the design of arc-welding generators the question of arc stability is of great importance, and many different schemes are used for obtaining it. The use of inductance properly disposed is commonly resorted to in obtaining this essential characteristic. In all types of welding generators inductance is placed in the external circuit, regardless of the type of frame construction used.

With laminated-frame construction it is true that the generator is more responsive to arc changes, but it is impossible to make these responses rapid enough to eliminate entirely the use of an external reactance, and for this reason the extra cost of manufacturing a machine of this design is not warranted when the same results can be obtained by using generators of less costly construction simply by using external reactance in the arc circuit.

If Mr. Pipes' inference that the damping effect in the generator frame is equivalent to placing a reactance in series with the arc circuit were correct, a laminated-frame generator would require more reactance in the arc circuit than would a solid-frame construction, because so-called damping effects are less in the laminated-frame construction. Actually, the greater the damping effect of the generator frame the larger is the reactance required in the arc circuit. However, this is such a minor point in the proper performance of a welding generator that it can be neglected.

The laminated frame has no practical advantages over the solid frame as regards the efficiency of machine operation. It is recognized that both hysteresis and eddy-current losses are less in a given volume of laminated sheet metal than for the same volume of rolled steel. However, the total iron loss in the frame of a machine is negligible compared with the iron loss in the armature. This is due to the fact that the flux changes in the frame of a generator through a range of certain positive values at a very low frequency, whereas in the armature of a machine the flux reverses from a maximum in one direction to a maximum in the other direction as often as an armature tooth traverses the distance between poles of opposite polarity. In fact, the iron losses in the frame of a machine will not be greater than one-fourth of 1 per cent of the total output of a machine, and for this reason can be neglected when establishing fundamental designs for arc-welding generators. Incidentally, iron losses in the frame of a machine are never considered in calculating machine designs.

Since, then, the efficiency of a machine is not appreciably affected by the type of frame construction, and since it is necessary to use an external reactance for either type of frame—that is, whether laminated or rolled—the solid-frame arc-welding generator should have preference over the laminated frame on account of its less expensive construction.

H. E. DRALLE,
General Engineering Department,
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

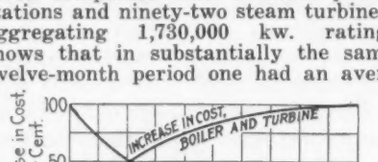
Higher Steam Pressures and Temperatures

IN COMMENTING on the paper presented at the annual meeting of the A. S. M. E. by George A. Orrok and W. S. Morrison (published in considerable detail in the Dec. 8 issue of the ELECTRICAL WORLD) Peter Junkersfeld brought out the vital question whether higher steam pressures and temperatures pay. He also called attention to the use factor of a number of turbine installations running from twenty to thirty hours per year up to 6,000 to 7,000 hours per year. Mr. Junkersfeld's discussion is given in part below:

Mr. Orrok shows that temperatures of from 700 deg. F. to 750 deg. F. should not be exceeded for the present, and in the accompanying illustration [reproduced from the paper] he shows that extra fixed charges are always greater than the saving of coal at $6 per ton for the Rankine cycle (ordinary operation) of 700 deg. F. maximum temperature. It is a comparatively simple matter to derive all but one of the curves for coal of a different price and quality. The exception is the curve of "extra fixed charges per kilowatt-hour." The determination of fixed charges is one thing, but fixing charges per kilowatt-hour is quite another matter. This curve will be high with some companies and low with others, being based on three items, namely, (a) extra construction cost, (b) percentage of interest, depreciation, etc., and (c) kilowatt-hours per year over which the number of dollars per year resulting from (a) and (b) may be spread. The effect of kilowatt-hours per year or annual output is so much greater on extra fixed charges per kilowatt-hour that for the purpose of discussion it may be assumed that the extra construction costs and the percentage of interest, depreciation, etc., are both constant for a number of central stations whose extra fixed charges per kilowatt-hour are to be determined. Only one factor has to be dealt with, namely, output or, as specifically defined, "generator capacity factor."

This factor, which is the ratio of the actual output t the possible output of a steam turbine as rated with all its accessories, when averaged over a period of years, is much less than usually supposed, especially among central stations that have a substantial annual average increase in output.

An examination of the experience of seven companies with fourteen power stations and ninety-two steam turbines, aggregating 1,730,000 kw. rating, shows that in substantially the same twelve-month period one had an average generator capacity factor on all its turbine units of 44 per cent and another had one of 25 per cent. The extra fixed charges per kilowatt-hour for the latter would be almost double that for the former. It was also noted that only two out of seven companies had an annual capacity factor of 60 per cent or better on any one turbine. The company whose successive installations apparently gave improved economy and reliability and which made good use of its equipment had the average capacity factors during a twelve-month period shown in the accompanying table. Only one company had turbines still available for use, two in number, that had been in service eighteen years, and only three companies had such turbines, nineteen in number, that had been in service fourteen years or more.



COST OF INSTALLING AND ECONOMY IN USING PRESSURES ABOVE 200 LB.

Saving afforded in cents per kilowatt-hour, based on the Rankine cycle at 200 lb. and 700 deg. maximum temperature and coal at $6 per ton. At the top of the figure are two curves showing the increase in cost of boiler and turbine and the decrease in size of pipe required for a given quantity of steam. The extra fixed charges are always greater than the coal saving for the Rankine cycle (ordinary operation) at 700 deg. F. maximum temperature, and the additional gain for 1,000 deg. F. maximum temperature barely exceeds the additional fixed charges.

AVERAGE CAPACITY FACTORS OF ONE COMPANY'S TURBINES FROM ONE TO ELEVEN YEARS IN SERVICE

Years of Turbine Service	Per Cent	Years of Turbine Service	Per Cent
1	77	9	3
3	55	10	4
4	38	11	2
5	32		—
8	23	Average	37

An average experience curve for these seven companies, all in large and growing cities, indicated a capacity factor of about 58 per cent on turbines one year old and 30 per cent or less on turbines ten years old. The actual average of five turbines that were eleven years old was only 20 per cent, but this point was below the average curve.

The falling off with age of the capacity factor of turbines reflects good operating procedure with improved equipment in the successive installations. The fact that only one company operated its one-year-old turbines at 77 per cent, another at 52 per cent, and the third at only 23 per cent, and that the average of ten turbines two years old operated by six companies was only 50 per cent, indicates that there is still very great room for improvement in construction and operation of equipment with what might today be called moderate pressures and superheat.

DATA ON HIGHER PRESSURE TURBINES INCOMPLETE

The turbines considered above were all operated at pressures from 150 lb. per square inch to 250 lb. per square inch at the throttle and total temperatures from 475 deg. F. to 600 deg. F. Some of the companies have turbines with 300 lb. pressure, but are not included because a full year's service had not been completed at the end of the year 1921, the period from which most of this experience record was taken.

In the foregoing wherever reference is made to turbine experience it means not only the turbine proper, but also includes the condensing equipment, piping and other mechanical accessories, the generator, excitation, switching equipment and other electric accessories.

The development toward higher steam pressure and superheat has been under way for many years and will inevitably continue. It should be given every reasonable encouragement consistent with established scientific facts and sound economic possibilities. It should be remembered however that this development in the past in a broad and over-all aspect has tended toward lower construction as well as lower operating costs of the station.

The development now seems to tend toward higher costs of construction and of operation with the exception of fuel. It thus becomes even more necessary than heretofore to determine proper balances between fuel saving and what Mr. Orrok has called "extra fixed charges per kilowatt-hour." The latter is, therefore, particularly important, and especially because experience has shown that it varies so widely from turbine to turbine, from station to station, from company to company and from year to year.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Relative Merits of Three Methods of Charging Batteries

AS IS generally understood, the constant-current method of charging both lead and nickel-iron batteries consists in connecting a variable resistance in series with the battery and connecting it to a charging circuit having any voltage higher than the full-charge voltage of the battery. The charging current is maintained virtually constant throughout the charge at the normal charging rate. This is accomplished by varying the resistance in series with the battery, adjusting it to give a current value slightly higher than the normal charging rate and, after the current has fallen off to a value below the normal rate, again adjusting it to a slightly higher value, thus maintaining an average equal to the normal charging current.

With a nickel-iron alkaline battery the charge is terminated when the voltage reaches approximately 1.85 volts per cell. In the case of a lead battery the charge is continued at the normal rate until free gassing begins, accompanied by a comparatively rapid rise of voltage, when the charging current is reduced to the finishing rate, which is somewhere between 25 per cent and 40 per cent of normal, depending on the make of the battery. This results in simultaneous reduction of the battery voltage, and the charge is then continued at the finishing rate until the battery voltage reaches a one-hour maximum as indicated by three half-hourly readings of equal values, the current being held constant, after which the charge is terminated.

In order to keep the charging current practically constant it is necessary to adjust the resistance at more or less frequent intervals, these intervals being dependent on the difference between the battery and the line voltages. With a battery having a voltage slightly lower than the line voltage, as, for instance, a battery of forty cells being charged from a 110-volt circuit, it will probably be necessary to adjust the rheostat at half-hour intervals; but for a similar battery being charged from a 220-volt circuit adjustments may be made at very much longer intervals. Observations of gassing and readings of battery voltage must be taken at suitable intervals to determine the points at which to reduce the rate and terminate the charge.

The chief objection to the constant-current method is the necessity for keeping a competent attendant to regulate the current from time to time and take voltage readings. If he is not attentive to his work, the batteries under his care will probably be either overcharged or undercharged, and in either case their useful life will be shortened.

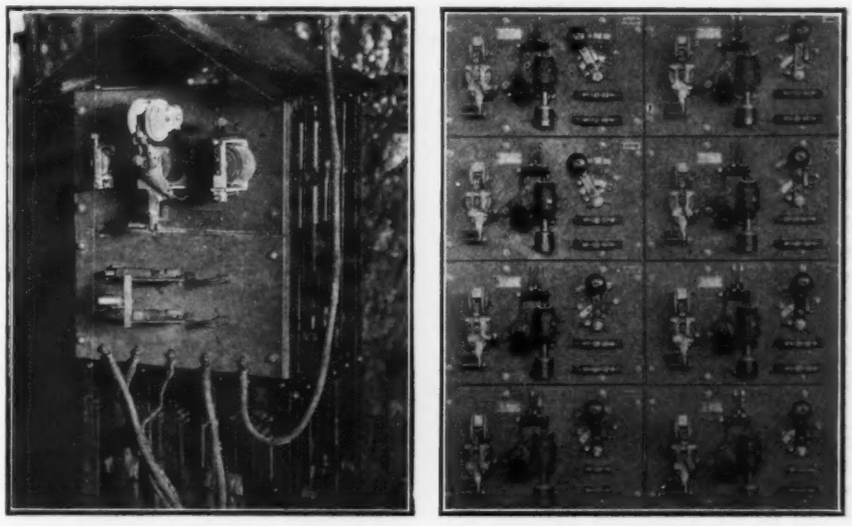
This objection to the constant-current method is not inherent in the constant-potential method of charging, the basis of which lies in the fact that a proper charge for any lead battery can be obtained by applying a fixed charging voltage of approximately 2.3 volts per cell.

In charging batteries by the constant-potential method the battery, without series resistance, is connected directly to a circuit, the voltage of which is maintained constant throughout the charge at a value determined by the number of cells in the battery. For lead batteries this voltage is ordinarily about 2.3 volts per cell and for nickel-iron batteries 1.7 volts per cell. In cold weather a somewhat higher voltage may be required. Under these conditions the time required for charging a battery which has previously delivered its rated output can be reduced to five or six hours in the case of a lead battery. Seven hours, however, is required for a total charge for a nickel-iron battery. This time is not changed regardless of the method of charging used, as the average rate of charge is equivalent to the normal rate. Owing to the fact that the battery voltage is low at the start of the charge, the charging current tapers, starting at a high value and falling off as the charge progresses. In the case of the lead battery the initial inrush current is about four times normal, and it is about twice normal for the nickel-iron battery.

The constant-potential method of charging requires a definite constant charging voltage for each battery, which voltage seldom, if ever, corresponds to that of a power circuit. It is therefore necessary to install a separate power supply or provide some special means of obtaining the proper charging voltage. Where batteries of different numbers of cells are used, the problem is more complicated as a different charging voltage may be required for each battery.

In the case of lead batteries an objection to this method of charging is the fact that the capacity of all the conductors must necessarily be increased about 300 per cent in order to provide capacity for the inrush current, which lasts only a few minutes. All fuses or other overload devices must also have a capacity for the maximum current and thus be useless as a protection throughout the remainder of the charge.

By inserting a resistor in the battery circuit, this heavy initial inrush is cut down to the point where heavy leads, switching equipment and fuses



FIXED RESISTOR METHOD OF CHARGING BATTERIES ELIMINATES KEEPING ATTENDANT ON DUTY DURING CHARGE

Left — Charging panel installed underground in mine for charging locomotives by this method. Right—Frame of eight resistor charging sections, each section controlling a charging circuit and having a remote control relay which automatically establishes the charging circuit upon plugging into the battery.

are not necessary. This is known as the fixed resistor method of charging, and retains the chief advantages of the constant potential method.

The chief advantage of fixed-resistor charging is that the expense of keeping a responsible attendant on duty is saved since no attention is required during the charge; and, as the battery automatically receives the proper amount of current at every stage of the charge, it receives better treatment than when charged by any method which depends upon the operator to adjust frequently the charging current at the proper value and to terminate the charge. This elimination of the human element is a strong argument for fixed-resistor charging with automatic ampere-hour meter cut-off, as the useful life of the batteries is probably shortened more often by improper charging than by any other cause.

F. LEPORT SPANGLER.

Cleveland, Ohio.

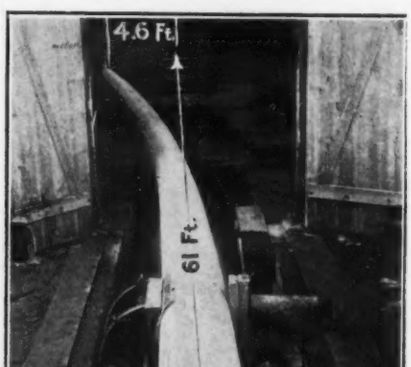
Concrete Poles Used on 132,000-Volt Line

Minimum Hazard of Contact and Maximum Adaptability at Low Cost Offered by "Pi" Construction—Puzzling Transportation Problem Solved

THE 132,000-volt cross-country trunk line recently built in Sweden between Trollhättan and Västeras is carried out for a stretch of about 80 miles on poles of steel-reinforced concrete. Though concrete poles have been used rather extensively in Switzerland and Germany for lines of moderate voltages, this line is believed to be the first extra high-tension development employing such poles.

The type of pole adapted for the line may be characterized as the Π type. Each pole consists of two masts, carrying a horizontal cross-beam 57 ft. from the ground, and the conductors are arranged horizontally 20 ft. apart. About 400 suspension poles on the line are built of concrete, some with steel, some with concrete cross-beams, the remaining 1,200 poles being made of structural steel, as are all the strain towers.

The concrete masts were manufactured by the so-called Schleuderbeton process. The reinforcement consists of steel rods placed around the circumference and interwoven by heavy steel wire. The steel skeleton is placed in a large hollow mold, which by special machinery is set in rapid rotation around its axis while the concrete mixture is poured in. Owing to the centrifugal action the surface layer of the concrete comes out extremely smooth and dense, and the poles exhibit a surprising strength and elasticity.

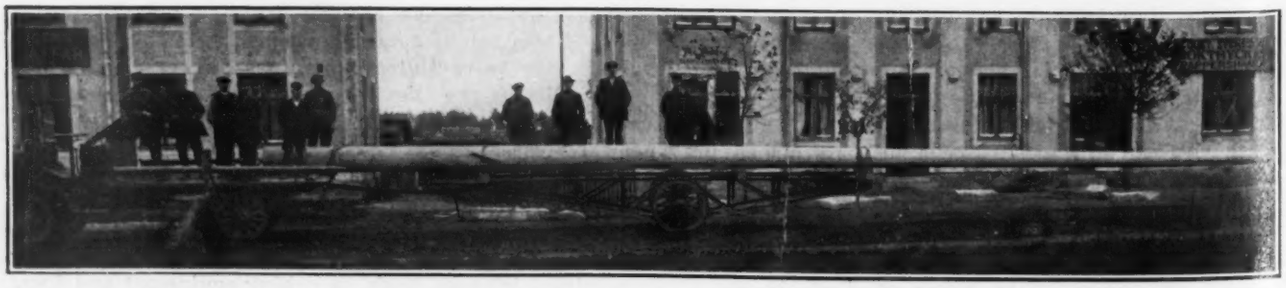


SMOOTH AND DENSE CONCRETE POLES SHOW SURPRISING STRENGTH AND ELASTICITY

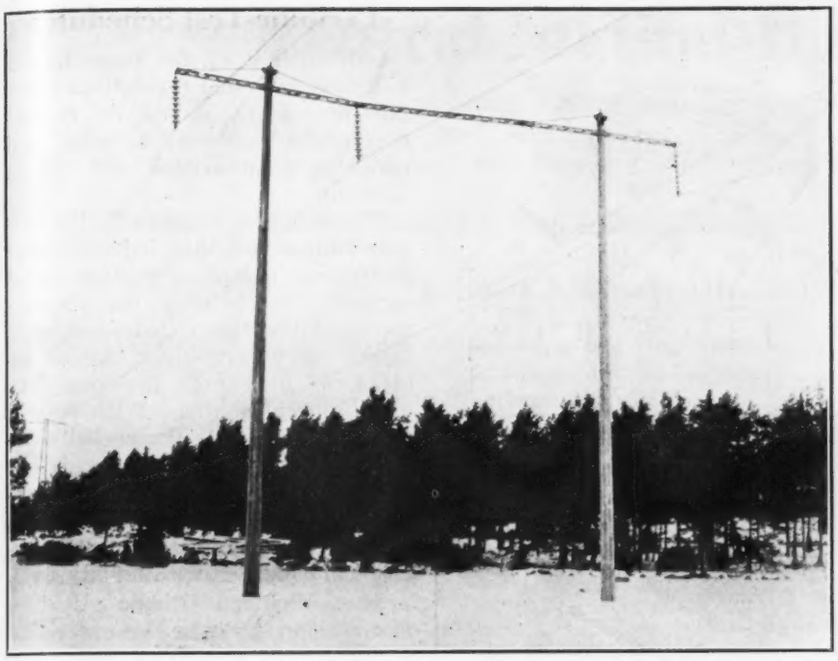
Each mast weighs about 8,000 lb., is 61 ft. long and has a diameter at the base of 19.7 in., tapering to about 9 in. at the top. The cross-beam weighs 4,400 lb. and is 59 ft. long, with a diameter of 11 in. The masts are guaranteed to withstand a cross-pull of 1,320 lb. at the top with a factor of safety of four. One of the accompanying illustrations shows a mast being tested at 6,750 lb. As indicated in the photograph, the top deflection at this pull was about 4.6 ft. After this exaggerated test the pole showed neither cracks nor permanent deflection. Later the same mast was tested up to 7,600 lb. and it then gave a deflection of fully 10 per cent of the pole height without breaking.

At first some doubt was felt as to the feasibility of transporting these large masts from the factories in Germany to their sites in Sweden without so great a degree of breakage as to make the expense prohibitive. The masts, however, proved to be much easier to handle than was anticipated, and not a single piece had to be discarded. The majority of the 800 masts were taken by rail and ferry, on special cars, nine to the cars, but some were reloaded on seagoing barges and towed to Gothenburg. The transport from the nearest rail station and out to the sites presented some puzzling problems but was managed satisfactorily in the following way: The base of the mast was anchored to a motor truck, and somewhat below the middle the mast was supported by a special trailer. When the truck could get no further the masts were rolled over the fields by two horses, each attached to a sling of wire rope around either end of the mast.

The other illustrations show how the masts were raised and the cross-beam being hoisted into place. With both masts in place concrete foundations were cast around the butts. From a practical point of view the poles proved successful, the simple method of pole erection cutting down field work considerably. Although the first cost—all transportation damages, etc., included—came out about as high as for the steel poles used on the line, the concrete poles probably will be cheaper in the long run, since concrete needs no



CONCRETE POLES CARRIED FROM GERMANY TO SWEDEN BY TRAIN, BARGE AND MOTOR TRUCK WITH NO BREAKAGE



A SECOND CIRCUIT MAY BE ADDED BY SIMPLY ADDING ONE POLE AND EXTENDING CROSSARM

painting and requires practically no upkeep.

The Π-type pole is not a special feature of this line. This type of construction with wooden poles was used to a great extent on 77,000-volt lines built in Sweden during the war, when structural steel was scarce. The poles have proved that they have several advantages besides that of being very cheap where considerations of right-of-way do not enter. Theory as well as practice show that the horizontal arrangement of the wires offers a minimum of hazard of wire contact due to sleet storms, frost, etc. Furthermore, the Π-pole can be easily adapted to meet a growing power demand. On the Trollhättan-Västeras line only three 200,000-circ.mil copper wires were pulled, although the poles are designed for conductors of three times that size. The line is operated at 132,000 volts, but the clearances in the poles will permit the voltage to be raised to 220,000. By simply adding one mast to each pole and extending the cross-beam space may be provided for six conductors, and even as the poles stand now there is room for a fourth (reserve) cable.

EDY VELANDER.

Stockholm, Sweden.

Fire-Extinguishing Liquid Specifications

SPECIFICATIONS for fire-extinguishing liquid, with carbon tetrachloride base, issued by the Federal Specification Board of the Bureau of Standards state that carbon tetrachloride is the only suitable liquid known which is a non-conductor of electricity for use in hand fire extinguishers in fighting incipient fires in connection with electrical apparatus. The board points out, however, that the fumes generated in extinguishing fires with carbon tetrachloride are intensely irritating and poisonous and that the liquid is unsafe for use in confined spaces. The specifications as officially adopted by the Federal Specification Board on July 3, 1922, are given in part below:

The liquid shall be capable of extinguishing fires caused by the burning of inflammable liquids and solids, shall be a non-conductor of electricity and shall consist of carbon-tetrachloride containing other suitable products necessary to produce a liquid conforming to the following requirements when tested according to the methods outlined in circular No. 134 of the Bureau of Standards:

Appearance — It shall be a clear, homogeneous, mobile liquid.

Specific Gravity—The specific gravity at 15.5 deg. C. shall not be less than 1.500.

Cold Test—The liquid must have a cold test not higher than minus 45.5 deg. C.

Distillation — Not over 2 per cent shall distill below 60 deg. C. At least 90 per cent shall distill between 70 deg. C. and 80 deg. C. At least 99 per cent shall distill below 100 deg. C.

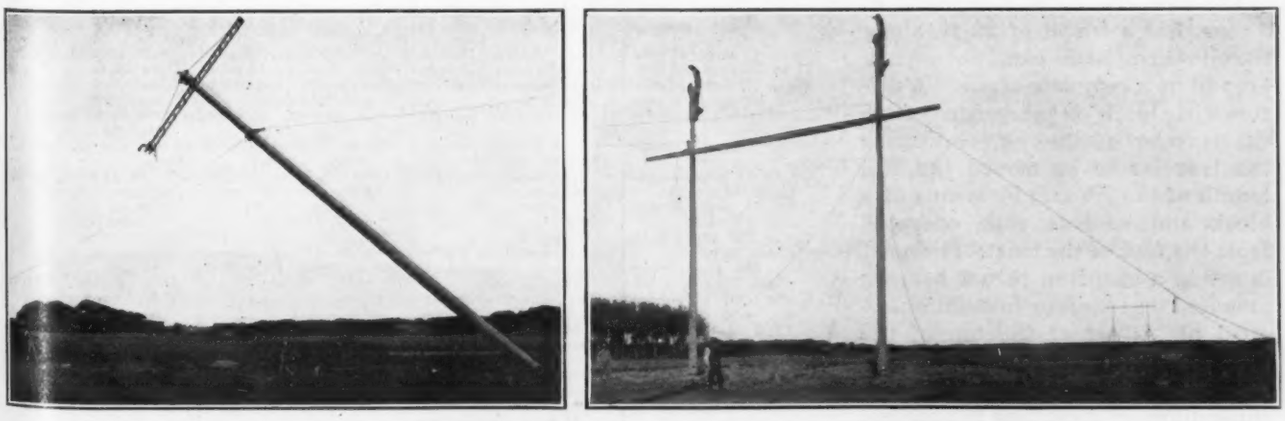
Impurities—The liquid shall be free from nitrobenzine, water, acid or alkali and free halogens, and shall not contain more than 1 per cent by weight of carbon disulphide. It shall not corrode metals used in fire extinguishers.

FIELD EDITOR ELECTRICAL WORLD.

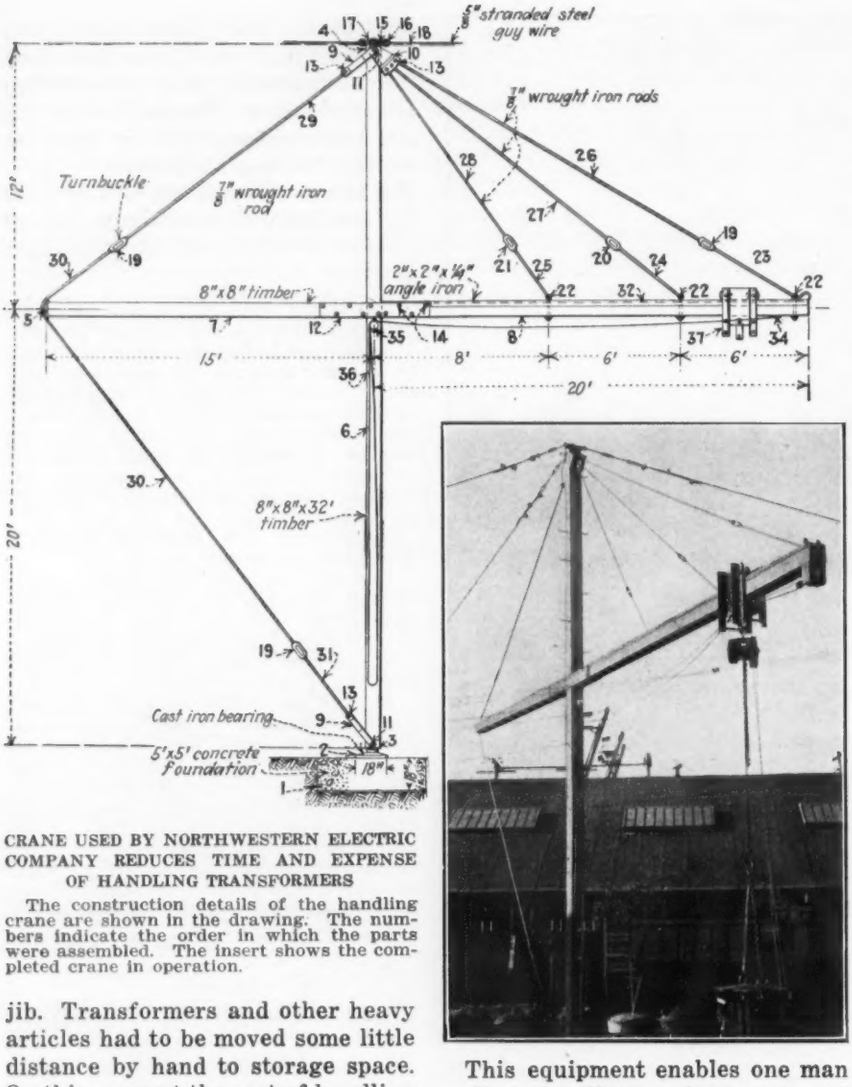
New York, N. Y.

Rotary Crane for Handling Transformers

FOR handling transformers and heavy wire reels in its main storeyard the Northwestern Electric Company of Portland, Ore., has installed a simple jib crane, shown in the accompanying illustration. Previous to this time a small rotary crane without jib traveler was used. This crane could be used only to swing heavy loads on and off trucks as it had no traveler on the



THE 8,000-LB. CONCRETE MASTS WERE RAISED AS ORDINARY POLES, WHILE CONCRETE CROSSARM WAS HOISTED BY SPIRAL DERRICKS



CRANE USED BY NORTHWESTERN ELECTRIC COMPANY REDUCES TIME AND EXPENSE OF HANDLING TRANSFORMERS

The construction details of the handling crane are shown in the drawing. The numbers indicate the order in which the parts were assembled. The insert shows the completed crane in operation.

jib. Transformers and other heavy articles had to be moved some little distance by hand to storage space. On this account the cost of handling several transformers and other material each day was quite an item. In addition, the time lost during the manual operation became of prime importance when it was necessary to take out transformers in case of emergency. Transformer bushings were quite often broken while the transformer was being shifted by hand.

The new crane has a capacity of 3 tons, has a travel of 20 ft. along the jib arm and can be swung around in a complete circle. A differential block is suspended from the traveler of the jib, permitting the traveler to be moved the full length of the jib arm by means of a block and endless rope operated from the foot of the mast. The mast is set in a cast-iron thrust bearing mounted on concrete foundation. A steel pin is set at the top of the mast, and by means of a loose collar on the pin the mast is guyed in three different directions to anchored stubs.

This equipment enables one man easily to handle transformers to and from the truck and storage space. The cost of the crane complete was approximately $425. It was designed and erected by the company.

E. F. PEARSON,
Electrical Engineer.
Northwestern Electric Company,
Portland, Ore.

Periodic-Test Schedules

A NUMBER of the more important rules and regulations relating to meters issued or revised during the past year by state and municipal authorities are given herewith.

The principal changes in the Illinois rulings are that induction-type meters not exceeding 25-amp. rated capacity, which meet the requirements of the Meter Code, are to be tested every forty-eight months instead, as under the previous rule, every thirty months. With respect to installation tests the period within which the test is to be made has been extended from sixty days up to one year, provided that the meter is inspected for connections and mechanical condition within sixty days.

The Michigan Public Utilities Commission has issued an order that includes some regulations governing metering and service methods. Definite rules on meter switches and trims have been issued by Detroit for that city.

The rules and regulations of the Public Service Commission of New York governing the testing of watt-hour meters and the reporting of such tests to the commission have been made to apply to the entire state, whereas the former rules applied to only part of the state.

The Public Service Commission of Montana has adopted rules and regulations prescribing standards for electric service. The rules relative to meters and meter testing are incorporated in this order.

A comparative tabulation of periodic test schedules as prescribed by four commissions is given below.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

COMPARATIVE TABULATION OF PERIODIC METER TEST SCHEDULES

New York	Illinois	Michigan	Montana
D. C. meters, periodic tests: Up to 25 amp., 30 mos. 25 to 200 amp., 18 mos. 200 to 400 amp., 12 mos. Over 400 amp., 6 mos. Installation tests within 60 days. A. C. meters periodic tests: Up to 25 amp., single-phase, 42 mos. Over 25 amp., single-phase, 24 mos. Up to 150 amp., polyphase, 24 mos. Over 150 amp., polyphase, 12 mos. Single and polyphase, not over 100 kw., 2,000 volts, 12 mos. Single and polyphase, over 100 kw., 2,000 volts, 6 mos. Test before or within 60 days of installation.	D. C. meters, periodic tests: Up to 50 amp., 18 mos. Over 50 amp., 12 mos. Installation tests within 60 days. A. C. meters, periodic tests: Up to 25 amp., single-phase, meters meeting code requirements, 48 mos. All others, 30 mos. Over 25 amp., single-phase, 24 mos. Self-contained polyphase, not over 50 kva., 12 mos. Self-contained polyphase, over 50 kva., 24 mos. Transformer meters not over 50 kva., 24 mos. Transformer meters over 50 kva., 18 mos. Installation test within 12 mos. and inspection within 60 days.	D. C. meters, periodic tests: Up to 50 amp., 18 mos. Over 50 amp., 12 mos. Installation inspection within 30 days A. C. meters, periodic tests: Up to 25 amp., single-phase, 36 mos. Over 25 amp., single-phase, 24 mos. Polyphase up to 150 amp., 24 mos. Polyphase over 150 amp., 12 mos. Installation inspection within 30 days.	D. C. meters, periodic tests: Up to 25 amp., 24 mos. Over 25 amp., 18 mos. Installation tests immediately before or within 60 days of installation. A. C. meters, periodic tests: Up to 25 amp., single-phase, 36 mos. Over 25 amp., single-phase, 24 mos. Self-contained polyphase up to 50 kw., 18 mos. Over 50 kw., 12 mos. Polyphase meters with current or current and potential transformers, 24 mos. Test before or within 60 days of installation.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Electrical League Co-operation

Better Business Methods Have Resulted from the Organization of Local Leagues in Eleven Districts Served by the Public Service Company of Northern Illinois

BASED on the theory that the better business man the contractor-dealer is the better it will be for the central station, the Public Service Company of Northern Illinois during 1922 was instrumental in the organization of electrical leagues comprising the contractor-dealers in the territory served by the company. Each local league, of which there are eleven, is under the direction of officers elected by the members and the contractor-dealers are represented 100 per cent. The Public Service Company of Northern Illinois also is a member and an active force in the work of each league.

Meetings of the leagues are held monthly, and among the important subjects which have been studied at these meetings has been that of cost keeping. Methods of handling cost records, the costs of material, overhead and profit, the effect of cut-throat competition without considering the cost of doing business, the organization of working forces, shop forces, analysis of actual costs on the job and the proper methods of estimating and bidding on jobs have been under consideration in the meetings.

Efforts have been directed toward better advertising and better window displays. Special work to improve the appearance of show-window cards has been done, and signs for the use of the contractors on their wagons or cars are also being prepared.

Methods of carrying deferred payments on appliances have been considered and financing plans provided. The installation of adequate electrical equipment, including convenience outlets, to take care of the future needs of the home owners and to pave the way for future merchandise sales, has been studied.

In the early days of the organization of the leagues it was discovered at the dinners held that many of the contractor-dealers did not know each other and that the central-station men and the contractor-dealers were in many cases unacquainted with each other. The leagues have remedied this, and in addition it has been possible to bring about a better understanding on the part of both the central station and the contractor-dealer of each other's difficulties.

A most gratifying accomplishment has been to give the contractor a true conception of the work that must be done by the central station in connecting up customers. This has brought about a co-operation between the contractor and the central station that has avoided many of the delays and troubles encountered in making new connections and has developed better service to the customer from both the contractor and the utility. Another subject has been the education of employees of the members of the league to appreciate that they have a vital interest in the business—in other words, they have been convinced that they are more than wage drawers.

Electrical Shows and Exhibits

One activity of the past few months is the construction of electrical homes. These projects have been handled by a building committee of the electrical league. The homes have been widely advertised, the names of the contractors responsible for the project being connected with the advertising. Electrical shows have been held under the direction of the leagues, and during this winter at least one of these shows will be held in each district.

For organization purposes the territory has been divided into arbitrary districts, usually by counties, though in the territory immediately adjacent to Chicago smaller divisions have been used. This has been a case of fitting the district to the organization desired by arranging it so that the men who would naturally be grouped together are brought into the same body.

Not only have the members of the leagues been provided with valuable educational material, but the central station has benefited from the co-operation. Among other things a substantial number of new stockholders have been obtained, and the better understanding brought about in the league association has made friends for the Public Service Company of Northern Illinois. In some cases where it has not been possible for the company to maintain convenient trouble organizations the contractors handle trouble calls.

While the work of the leagues has been under way only a year, the results in better service and better business relations make the members very enthusiastic over future possibilities. The work has been carried out as far as the Public Service Company of Northern Illinois is concerned by the company's district superintendents, who are: Theo. Blech, Waukegan; J. S. Reesman, Evanston; H. L. Judd, Oak Park; G. E. McCollum, Crystal Lake; O. L. Hyatt, Chicago Heights; L. C. Stephens, Joliet; B. G. Smith, Kankakee; J. A. Schabeck, Lacon; W. J. Brown, Ottawa; V. V. Parshall, Pontiac; W. C. Dowdy, Streator, and T. J. Mulvey of the contract department, under the direction of John C. Learned, assistant to vice-president.

New York Edison Schedules Seven Special Exhibits

THE recently organized Bureau of Exhibitions of the New York Edison Company, under whose auspices all future specialized electrical exhibits by the company are to be held, has announced a schedule of seven shows to be held between January and June. These seven shows will cover electric signs, electric heating, household equipment, electro-therapeutics, ventilation and refrigeration and electric trucks. All the

displays will be in the Irving Place showroom of the New York Edison Company and will be free to the public. As with previous shows of this sort, the exhibits will be by invitation and there will be no sale of space to exhibitors.

The electric sign show will be the first of the series. It will be held during the week of Jan. 29 to Feb. 3. The other shows scheduled are as follows: Heating, Feb. 19 to 24; washing machines, ironing machines, and dishwashers, March 12 to 17; power, ventilation, and refrigeration, April 2 to 7; electro-therapeutics, April 23 to 28; vacuum cleaners and floor machines, May 14 to 19; electric trucks, cars and accessories, June 4 to 9.

The general management of all the shows will be under the direction of Lincoln Bancroft, manager of the bureau of exhibitions, but in each show he will be associated with the manager of the department of the Eidison company specializing in that particular field.

Comparison of Utility Rates with Commodity Prices

THE relation of gas and electric rates to commodity prices and the cost of oil is shown graphically in the accompanying chart prepared by the Railroad Commission of California. It includes the years 1914 to 1922, covering the pre-war, war, reconstruction and "return-to-normalcy" periods. In its annual report the commission states that there was a downward trend in the cost of several important classes of public utility service in the fiscal year ended June 30, 1922, and that a corresponding reduction was concurrently reflected in public utility rates. Regulation, the commission adds, has demonstrated its flexibility and its responsiveness to general economic conditions. It is shown that the maximum increase in electric rates over 1914 levels was 36 per cent and the present excess is approximately 16 per cent, while commodity prices soared to 173 per cent over normal at the 1920 peak and are still between 60 and 70 per cent above pre-war prices.

The information compiled by the United States Department of Labor showing the variation of the wholesale price index over the period from 1914 to April 1922, has been used to plot the curve of commodity prices in the chart. A study of this index curve will show that the average price has increased from a basis of 100 per cent in 1914 to a peak of 273 per cent during the early part of 1920. Just after this peak was reached there was a very sudden decrease to 150 per cent during June of 1921. From that time to the present the index price has slightly increased.

In comparison with the variation of this wholesale index price it is interesting to compare the variation of electric rates of utilities operating in California. Considering the rates of the Pacific Gas & Electric Company, it will be noted that the maximum increase in electric rates of this utility occurred during the middle of 1920, and on the basis of the rates during 1914, assuming them to be 100 per cent, the maximum increase amounted to 34 per cent. This maximum increase remained in effect for a period somewhat less than a year, when during the early part of 1921 rates were lowered to the present charges, which are approximately 23 per cent above those in effect in 1914. In the same way the increase in the rates of the Southern California Edison Company made these 43 per cent in excess of 1914 rates. The maximum increase lasted for only nine months, and on Jan. 1, 1921, rates were reduced by about 6 per cent and again in April by 5 per cent. A further reduction in May, 1922, of 10 per cent brought about the present rates, which are now approximately 16 per cent above the rates in effect during 1914.

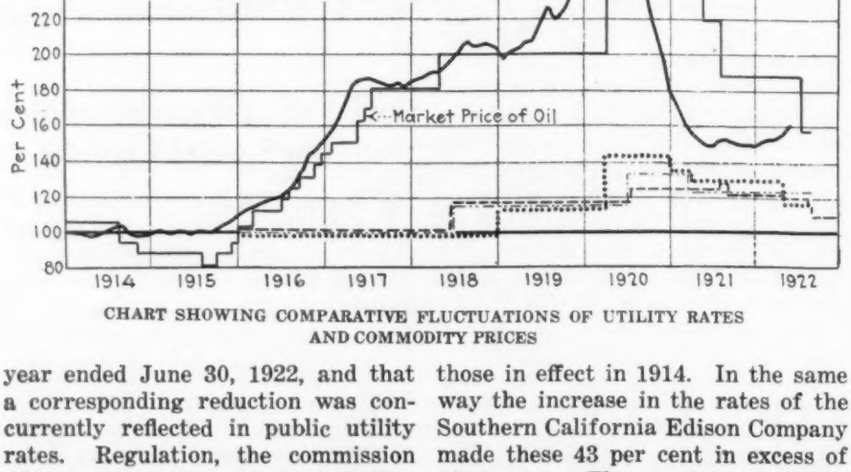


CHART SHOWING COMPARATIVE FLUCTUATIONS OF UTILITY RATES AND COMMODITY PRICES

The rates of other utilities varied in a similar manner to those of these two companies. The average maximum increase of rates for all electric utilities in the state did not exceed 35 per cent over the 1914 rates. The increase of 173 per cent in the price of commodities was over five times the increase in electric rates during this period.

Electric Ranges Serviced by Dealers

BY W. M. CRAWFORD
General Agent California-Oregon Power Company, Medford, Ore.

AFTER trying out and discarding a number of plans for servicing electric ranges, the California-Oregon Power Company has adopted a very satisfactory arrangement whereby the electrical dealers service the electric ranges they sell. The company replaces fuses and renders only such service as it would to a power customer or any other consumer on its lines.

This company actively entered the range field in 1912, when the electric range was not so reliable a piece of electrical apparatus as it is today. At that time it was necessary for the power company not only to adopt a very liberal servicing policy but to sell and in many cases install the range as well.

About 1916, at the request of the dealers in this territory, the company increased the prices of ranges to a point where the dealers could make a legitimate profit on their sales, and the company maintained prices so that the dealers could go after the business. Before that time the company had been selling ranges at only a small percentage above cost. The company still continued to sell ranges and also to service them, making charges for the servicing at prices which the dealers maintained were unprofitable.

The contractor-dealers also serviced ranges and the company used its influence to throw this business of maintenance to the dealers where it could be done without losing the good will of the customers. In 1918 the company discontinued the sale of ranges, throwing this business

entirely to the dealers, who by this time had become quite active. It also discontinued servicing ranges at the same time, and this practice has been continued ever since. The company's activity in connection with range sales since that date has been confined to efforts through the dealers. All sales are made through the dealer — the dealer installing the range and thereafter servicing it.

We believe that we have been reasonably successful in this procedure, inasmuch as 23 per cent of all of our residential customers in this district have electric ranges installed and we have eliminated a great deal of work and expense.

"The Public Servant"*

Application of Some Ancient Laws Which Give a Refreshing Slant to Present-Day Public Relations Problems of the Utility

BY DONALD MCDONALD
Vice-President and General Manager
Louisville Gas & Electric Company

WHOEVER coined the expression "public servant" to describe the utilities performed a real service both to the companies and to the public. No relation of life is older or better understood than that of master and servant. The oldest code of written law is that of Hammurapi, an ancient king of Babylon, which provides among other things for the relation between master and servant. The law of Moses enjoins on the servant diligence, honesty and efficiency; it enjoins on the master justice, kindness and intelligence.

Among the other wise statements contained in the Bible is the one which says "No man can serve two masters." People are prone to forget this. National laws commanded the railroads to obey the Interstate Commerce Commission, whose jurisdiction covered the whole of the United States. State laws commanded the same railroads, within the limit of the state, to obey the rulings of the State Railroad Commission. In some cases these rulings conflicted, and endless confusion resulted.

CONFLICT OF AUTHORITY OVER SERVANTS

Other public utilities were placed under state commissions, while at the same time certain cities claimed and exercised the right to regulate these same utilities. Recent enactments have wiped out most of these conflicts, but the fact is just as true as it was four thousand years ago that no servant can serve two masters.

The relation of master and servant imposes on the servant the exercise of a certain deference to the wishes of the master, even when the master is somewhat unreasonable. A wise public servant will remember this. People will neglect to apply for gas until the weather is actually cold, and then forget that a hundred others have done the same thing and each one feels that he should be served first. A certain amount of good temper in picking out the hardest cases and a large amount of hustling, so that two days' work may be done in one, in this way relieving people from the consequences of their own carelessness, will help the company.

We also learn from Holy Writ that "the laborer is worthy of his hire," and no man promotes his own comfort or interest by beating down that hire to a point which is below the cost of decent living. People are proud of the fact that their servants are well housed, well fed, well paid and contented. I have heard them boast of how cheaply they bought goods, but I never heard a man boast of the fact that his servants were underpaid or underfed. I have, however, heard men boast that in their city the street-car fare was five cents, although they knew that the actual cost of carrying them was more than that. On the whole, communities have reached a saner and more just attitude toward the public utilities.

The relation of master and servant implies not only diligence and respect on the one hand and justice and consideration on the other, but it also implies mutual knowledge of the difficulties and perplexities which each side is compelled to face. Service that would be adequate on ordinary days becomes inadequate when sickness or death invade the house, or when a wedding or a funeral brings a large number of people to the master's house and to his table. At such times the servant must make unusual effort and do his very best to see that the emergency is adequately met. Fires and floods and fairs impose similar duties upon the public utilities. The demand upon them increases suddenly and the importance of their service to their pa-

Your Obedient Servants
At your beck and call, day and night, always and forever, stand the great public utilities—they are your obedient servants.
We Are Your Obedient Servants
Louisville's Public Utilities
Louisville Railway Co.
Louisville Gas & Electric Co.
Louisville Home Telephone Co.

PREACHING THE GOSPEL OF SERVICE

Mr. McDonald's paper has been very favorably commented on by the press throughout Kentucky, and, following up the public-servant idea, three of the Louisville utilities combined to issue the accompanying advertisement on New Year's Day.

*From an address at the annual meeting of the Kentucky Association of Public Utilities at Lexington, Ky., Dec. 12, 1922.

trons becomes even greater than usual.

The wise manager is prepared for such emergencies, but in order to be prepared he must have such a revenue as will enable him to pay all of his bills promptly and to pay a fair return upon the investment which has been made by his stockholders. Without this he cannot enlist the additional capital which is necessary to provide far in advance the machinery which will be needed to meet the emergencies when they come.

THE DIGNITY OF SERVICE

The rôle of public servant is an honorable rôle. Again we can quote scripture in saying, "He that would be greatest among you, let him be your servant." Every man who is neither a thief nor an idler nor a beggar serves some one. He has at least one master. If he is highly placed, he is apt to have many masters. The President of the United States serves more people than any other man I know. The head of a great corporation appears at a glance to be almost an autocrat. "He sayeth unto this man, 'Come,' and he cometh, and to another, 'Go,' and he goeth," but he cannot with impunity violate the sense of fairness which is in the minds of all those that look to him for orders, he cannot be arbitrary and he cannot be unreasonable. More than this, he must himself take orders from his stockholders and from the representatives of the public.

All that the public utilities have a right to ask is that in public matters the public speak with one voice, that they speak through an authority which is recognized by both sides, and that that authority informs itself of the facts before it issues orders.

CONSIDERATION OF THE MASTER FOR THE SERVANT

The most momentous event in human history came through the failure of a master to inform himself as to the needs of his servants and to adopt a sympathetic attitude toward those needs. Pharaoh said to the children of Israel, "Make bricks without straw, and the tale of the bricks shall not be diminished." In other words, these overburdened slaves must go into the fields and gather stubble, and in spite of the time lost in this way they must make as many brick as they made before, when the straw was delivered to them. Of course, there was great discontent and great wailing. There followed hail and storm, plague and pestilence, and eventually Pharaoh yielded and allowed them to go. He not only allowed them to go, but he speeded their parting in every way—in fact, he thrust them out.

It frequently happens that "the wrath of man is made to praise God"; that the mistakes and stupidities and stubbornness of a utility on the one side or of a municipality on the other finally result in a better day for both sides. But the better day comes after plagues and storms. It is much better that each side should recognize the rights and the interest of the other. It is much better that the utility take care to be a good servant and that the municipality take care that it shall be a good master.

Oklahoma's Municipal-Plant Shutdowns

IN 1922 a large number of individual electric light plants were sold or abandoned in Oklahoma. Ten of these were municipally owned. These towns decided to dispose of their plants and take energy from the high-tension lines of privately owned companies.

Among the towns are: Okemah, which has signed a contract with the Oklahoma Power Company; Heavener, which sold its plant to the Oklahoma Gas & Electric Company; Hunter, Billings, Watonga, and Geary, which gave up municipal plants to take service from the Oklahoma Gas & Electric Company; Boswell and Soper, which signed a contract with the Public Service Company of Oklahoma; Ramona, which voted to abandon its municipal plant to receive service from the Sand Springs Power, Light & Water Company; Wapanuck, which sold its plant to the Public Service Company of Oklahoma; Pawhuska, which was connected with the high-tension line of the Sand Springs Power, Light & Water Company. Norman and Lawton abandoned their municipal electric lighting projects and are buying energy from the Oklahoma Gas & Electric Company. Eldorado a few weeks ago completed a high-tension line to the plant of the Quana Light & Ice Company at Quana, Tex., and Purcell is now negotiating for electricity over a line which is to be extended south from the town of Norman and through Noble to Purcell.

What Other Companies Are Doing

Boston, Mass.—Seventy-one percolators were sold in one day recently by the Edison Electric Illuminating Company of Boston in the Davis Square district of Somerville in a co-operative movement with the local Chamber of Commerce designed to encourage popular buying in particular neighborhoods.

Illinois.—Electrical homes built in the Chicago territory during 1922 have not fallen behind the pace set in other districts. In River Forest, a Chicago suburb, a twelve-room house costing $60,000 was constructed during the summer. It contained a total of 200 outlets connected to thirty-two standard appliances and drew an attendance of 30,000 with an average daily number of visitors of 1,200. This house was planned by an organization of electrical contractors and the Public Service Company of Northern Illinois. During the fall a smaller house was built in Wilmette which combined the use of gas and electricity. Then in December, at Hammond, Ind., a house costing $20,000 was opened, also built through the efforts of the local contractors and the utility company.

Altoona, Pa.—Thirty new electric display and advertising signs were erected in Altoona during the twelve months of 1922, according to the annual report of Building Inspector M. W. Craine. The total is the largest for any year in the city's history and followed the adoption by the city of a favorable ordinance regulating the use of overhanging electric designs.

Berlin, Wis.—To create interest in water-power development the employees of the Wisconsin Power, Light & Heat Company have constructed a miniature hydro-electric plant which is being displayed in the various cities which the company furnishes with power. The model is an exact reproduction of the power plant at Prairie du Sac and represents the dam and power house on the Wisconsin River there.

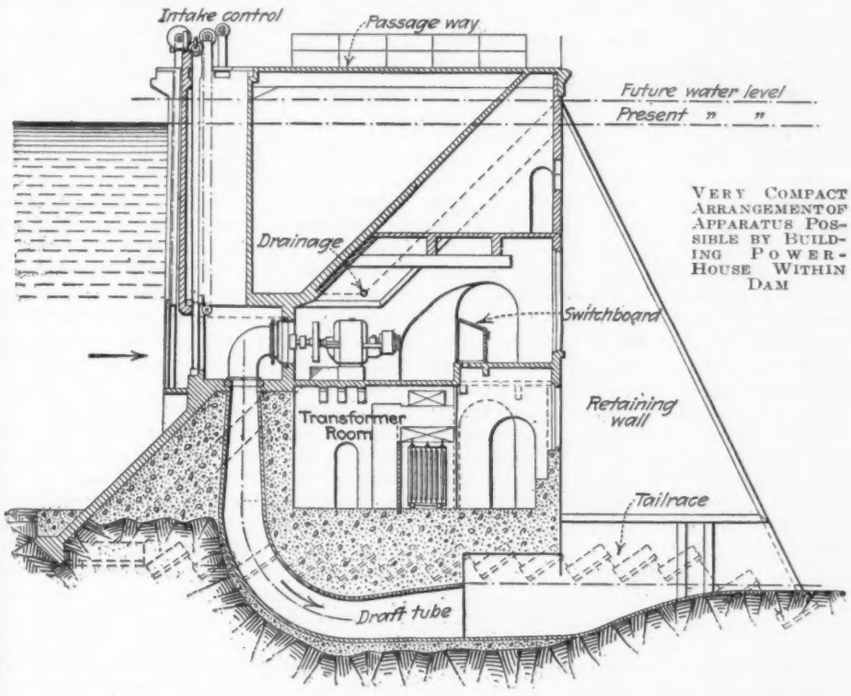
Worcester, Mass.—The New England Power Company plans to erect a new 110,000-volt transmission line from Davis Bridge, Vt., to Millbury, Mass., enabling energy to be obtained from the new development on the Deerfield River now under construction to be utilized in the central Massachusetts district.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Hydro-Electric Station Built Into a Dam.—A power house built compactly into a dam is described in this paper, the first of its kind in France and probably in Europe. Across the river Léguer, near the British Channel, at Belle-Isle-en-Terre, a reinforced-concrete dam inclined at 45 deg. and consisting of fourteen semi-circular vaults



VERY COMPACT ARRANGEMENT OF APPARATUS POSSIBLE BY BUILDING POWER-HOUSE WITHIN DAM

has been erected. The three middle compartments serve as engine room and have each three stories. On the lowest level are placed the transformers, the middle tier carries the turbines, alternators and bench-type switchboards, and the upper story contains the buses and protective apparatus. The three turbine sets, each of which is inclosed in an individual vault, are of different sizes, 175 hp., 300 hp. and 600 hp. The third unit has not as yet been installed. A hydraulic head of 10.8 m. is available for these horizontal-shaft Francis turbines, to which the generators are directly connected. About one-third of the head is utilized in draft tubes from the turbines. The transformers transform the machine voltage of 220 to the transmission voltage of 15,000, supplying a paper mill 4 km. away. The limited height of the power-house vaults did not permit the installation of a crane. The hydraulic part of this station is of a design very unusual in France, and the bulk of the article is devoted to detailed description of this, including also a general description of the entire plant.—*Génie Civil*, Dec. 9, 1922.

Economic Design of Power Plants.—H. MIDGLEY.—The author presents certain elementary facts which are rarely put before young engineers in training and gives such information on cost as affects design and concerns the preparation of estimates. In the comparison of plants an attempt should be made to estimate the relative cost of repairs. Even though the estimate may not be quite accurate, such a procedure will lead to a much closer comparison of the relative importance of various factors than would otherwise be obtained. For power producers on a high load factor using fuel at an average price it is worth while paying the extra sum required by highly economical plants. For power producers on a low load factor and for standby plants the cheapest possible plant should be installed consistent with reliability, but almost regardless of fuel consumption. —*Beama*, December, 1922.

Transmission, Substations and Distribution

Experiences with Aluminum Wires.—A. G. ERFTWERK.—The data contained in this short article, describing a practically copperless substation for smelting works, are of interest. The station receives its power over four three-phase lines of steel-aluminum, each with a total cross-section of 105 sq.mm., of which 25 sq.mm. is steel, at a voltage of 110,000. Joints in these cables, which were manufactured in 2,000-m. lengths, are made with galvanized-iron clamps with inlaid sheets of aluminum. These lines have been in operation for four and one-half years. The three main transformers, each rated at 30,000 kva., 110,000/5,000 volts, have aluminum windings and have given uninterrupted service. Fifteen rotaries of 4,000 kva. each have aluminum high-voltage windings with welded joints. Between these rotaries and the switchboards aluminum cables of the underground type are used. All buses and connecting lines of the 5,000-volt system are of aluminum. Owing to the high expansion coefficient of aluminum some of these connections on the disconnecting switches worked loose, heated and finally melted off. This was found to be due to too small a contact surface, and after enlarging the contacts 100 per cent no further trouble was experienced. All bars between the rotaries and the smelting furnaces, carrying 12,000 amp. at a density of 0.7 amp. per sq.mm., have given satisfactory service. A large number of rubber-insulated aluminum wires are used for the distribution of light, all joints being made on brass terminals in the junction boxes. Up to the present no electrolytic trouble of any kind has arisen.—*Elektrotechnische Zeitschrift*, Dec. 7, 1922.

Units, Measurements and Instruments

Use of Condenser Bushings for Measuring Purposes.—G. KEINATH.—Bushings built upon the condenser principle, such as are used extensively on high-voltage oil switches, transformers or wall-entrance leads, may be easily arranged to measure voltage, frequency, charging current or insulation, or to synchronize machines, whenever a moderate accuracy is sufficient. Atmospheric conditions may introduce an error of up to 5 per cent. Between the last and next to last condenser layers of such a bushing a static voltmeter may be connected to measure, after proper calibration, the voltage against ground. To measure the insulation against ground of very high-voltage lines during their operation, the author suggests connecting the two last condenser layers to the primary of a specially designed but inexpensive current transformer, insulated for only about 6,000 volts, with a winding ratio of 1 to 170, transforming the primary current of 3 milliamperes to 510 milliamperes, and energizing with the latter current a standard soft-iron instrument calibrated in volts. In a similar way, frequency meters of the resonating comb-type system, or synchronizing meters, may be connected over a small transformer to a condenser bushing. A considerable saving may further be realized in watt measurements by combining an ordinary current transformer with the above transformer connected in "V" to two con-

denser bushings. The charging current of these two bushings for a three-phase line is in phase with the Y-voltage and is fed over the small transformer to the moving coil of the watt-meter, while the stationary current coil is energized from the secondary of the standard current transformer. All of the new high-voltage condenser bushings of one German concern are now equipped with bands connected to the last two metallic layers to enable the customer to take advantage of the simple measuring methods mentioned in the description above.—*Siemens Zeitschrift*, November, 1922.

Illumination

Development, Present Status and Problems of Electrical Illuminants.—H. LUX.—The author outlines the historic development of arc and incandescent lamps. It is shown that it is economically wrong to try to increase the amount of light from a filament by an increase of its temperature, because a visual efficiency of only 14½ per cent can be reached theoretically. With increasing temperature the maximum of radiation is gradually shifted from the long-wave end of the spectrum into the short-wave end. At 3,600 deg. the radiation enters into the just visible red end at 800$\mu\mu$ and leaves the visible end at 7,200 deg. at the violet end, at 400$\mu\mu$. The highest visible efficiency is reached at 5,200 deg. at a wave length of 556$\mu\mu$. If we should succeed in developing a radiator emitting only visible rays, the highest possible light energy would be reached at 4,250 deg. with 248 lumens per watt. A light source with 100 per cent efficiency could be obtained from a radiator giving off rays near the 556$\mu\mu$ maximum. Such a light would give the highest possible output—about 650 lumens for each watt input. But we are far from having reached the ideal light emission of 247.5 lumens per watt. The flaming arc gives 40 lumens per watt, and the mercury vapor lamp in a quartz tube 54 lumens per watt, but their light is quite disagreeable. Another matter of great importance is the light density. It rises enormously with the temperature. With a black body radiating at 6,500 deg. a density of 73,000 cp. to 150,000 cp. per square centimeter is obtained for a bright body or other selective radiator. Such a terrific density would cause instant blinding. A flaming arc gives a density up to 1,000 cp. per square centimeter, which is so high that artificial means have to be employed to lessen the glare. New and more promising ways of obtaining the ideal source of light are shown by the modern electronic theories. If electrons are emitted from a hot cathode and allowed to hit the atoms of a vapor or gas at low pressure, they will be reflected until the reflection potential is reached, when the entire energy of the impulse is absorbed and the radiation of a spectral line is generated without ionization. If now the pressure is increased to the ionization value, all electrons will be driven out of the atom and will unite to form a new atom, forming a complete spectrum. Assuming, for example, a tungsten cathode heated to 2,800 deg., an electron stream of 8.4 amp. per square centimeter is available, producing in the ideal gas a light at 2.2 volts, resulting in 12,300 lumens. To heat the cathode 126 watts will be required, resulting in 2,300 lumens, which would give a total of 12,300 + 2,300 ÷ (18.5 + 126), or 101 lumens per watt. — *Elektrotechnische Zeitschrift*, Nov. 23 and Dec. 7, 1922.

Motors and Control

Selection of Electrical Systems for Iron and Steel Works.—J. MACSHEEHY.—The author describes the demands that iron and steel works make on the electricity supply and discusses the system which he considers most suitable for meeting these demands. Stress is laid on the necessity for thermal efficiency, reliability, adaptability and standardization. The three possible systems of generation, transmission and distribution are considered. The direct-current motor is shown to be the most efficient for intermittent duties.—*Electrician*, Nov. 24, 1922.

Use and Maintenance of Safety Switches. — R. B. ANDERSON. — The author takes up typical safety-switch applications and discusses some of the factors that enable this type of switch best to carry out the fundamental purposes of its construction and use in the operation of industrial motors. Because a safety switch is inclosed and made as nearly accident-proof as possible, many men responsible for maintenance forget that it is an operating mechanism and should have inspection and attention of the same nature that is paid to the vital parts of any other system.—*Industrial Engineer*, November, 1922.

Traction

Methods Used to Lessen the Corrosive Effect of Stray Currents from Street Railways.—H. F. ZANGGER.—The author assumes an imaginary street-railway network with given currents at all feeding points and calculates the return currents through the rails and the ground for all sections of the system. It is shown how the dangerous stray currents through the ground which corrode metallic pipe lines of gas and water systems can be reduced to an almost negligible amount by a judicious location of feeding points and the use of additional return-current cables of proper cross-section. A graphical representation of the stray currents along the sections shows in a striking way the large improvements which can be realized by such a reconstruction of any existing rail system having excessive stray currents. The author enlarges further upon his example by adding new extension lines to the improved system, and shows that to keep stray losses down additional return cables would have to be installed in the previously perfect system to take care of unbalancing of network introduced by added lines.—*Bulletin de l'Association Suisse des Electriciens*, November, 1922.

Heat Applications and Material Handling

Possibilities of Electrical Precipitation in the Chloride Volatilization Process.—THOMAS VARLEY and H. W. CLARK.—The Cottrell process of electrical precipitation was described in the November, 1921, issue and a number of its applications have been dealt with, particularly those with reference to the precipitation of fumes from furnaces for treating tin drosses (December, 1921), dust from cement mills (February, 1922) and the cleaning of blast furnaces (July, 1922). In this article the authors describe the possibilities of electrical precipitation in the chloride volatilization process. In the event that the electrical precipitator for this service proves a commercial success—and from the tests described this seems probable—the results will be far-reaching and extensive changes from what is now considered standard practice may be looked for within a comparatively short time. — *General Electric Review*, December, 1922.

Telegraphy, Telephony, Radio and Signals

Sensitivity and Precision of the Electrostatic Transmitter for Measuring Sound Intensities.—E. C. WENTE.—By means of a "pistonphone" and a thermophone, for which corrected formulas are available, both the absolute sensitivity and the phase lag were determined for frequencies of from 10 cycles to 12,000 cycles. Eight transmitters similarly constructed give the same curves within 20 per cent. Combined with an amplifier of ordinary design, the instrument has an over-all sensitivity which is practically uniform from 25 cycles to 8,000 cycles. It is therefore remarkably well adapted for the measurement of the intensities of complex tones and tones of changing pitch and for use with an oscillograph for recording sound waves. If sounds of a definite pitch are to be measured, the apparatus can be made highly selective and almost any desired sensitivity can be obtained by using a tuned amplifier in connection with a vibration galvonometer.—*Bulletin B-7-1 of the Engineering Department, Western Electric Company.*

Secondary Standardizations of Radio Wave Meters.—A method of standardizing wave meters for both the transmitting and receiving type is described. In the receiving type the standardizing consists in measuring by means of a standard wave meter the frequencies emitted by a generator of continuous waves which is tuned to resonance with the wave meter under test at various settings of the scale of the latter. In the transmitting type the process utilizes the make and break of a buzzer which excites the wave meter by impact and emits waves the frequency of which is regulated by the wave-meter setting. (A limited supply of this letter circular is available to persons who have use for such information.) *Letter Circular No. 75, Bureau of Standards.*

New Books

Reviews of the Latest Contributions to
Technical, Industrial and Commercial Literature of Particular Interest
to Members of the Electrical Industry

Year Book of Wireless Telegraphy and Telephony, 1922

London: The Wireless Press, Ltd. 1,472 pages.

In this, the tenth successive issue of the "Year Book of Wireless Telegraphy and Telephony," no change of importance has been made in arrangement or subject matter; in fact, much of the material was taken from the 1921 volume. The standard sections have, however, been revised and brought up to date. If the material included in the sections on "Wireless Developments (1827-1921)," "The Birth and History of Long-Distance Telegraphy" and "Biographical Notices" were expanded and published in a separate volume, a service would be rendered. There appears to be no reason why this historical matter should be included in a year book already overgrown. Approximately one-third of the book is devoted to the radio laws and regulations of all countries of the world and one-third to a directory of land and ship stations. With a few exceptions, private and experimental stations are not included in the book.

The year book fulfills its function of giving information regarding developments of the preceding twelve months in the sections on "National Résumés of Technical Progress in Radio Communication," "Patents," "New Radio Books" and a résumé of articles published during 1921 which are of particular value. Interesting technical articles on the "Progress of Wireless Telephony in Aircraft," "The Recording of Wireless Signals," "The Rectification Effect in the Reaction to the Composition and Structure of Crystals" and "The Earthing Resistance of Antennæ" are included. The section on standard wireless publications is convenient for reference purposes. In view of the phenomenal growth of interest in amateur activities in this country during the past year, it is rather surprising to find no mention of the development of radio broadcasting or the influence it is exerting upon the general public. H. M. TURNER.

The Electrometallurgy of Steel

By C. C. Gow. New York: D. Van Nostrand Company. 351 pages.

This book recounts the historical development of the electric furnace and gives considerable information on the electrical characteristics of the various types of furnace. A part of the volume is given up to highly theoretical electrical features of various furnaces. This possibly represents the author's chief interest. The matter relating to the metallurgical side of the problem is a summary of what has been covered in previous literature. The book presents no very striking advance in known facts, but if one wishes an elementary survey of the general field it will be found in this volume in very readable style. E. E. THUM.

Machines Electriques: Theorie, Essais et Construction

By A. Mauduit, professor in the faculty of sciences at Nancy, France. Third edition. 1,180 pp., illustrated. Paris: Dunod.

In an analytical preface to this work, Prof. A. Blondel gives an estimate of its value which is so comprehensive that an abstract will serve better than anything else to show just where it fits in. Professor Blondel says that he has a high opinion of the achievements of Professor Mauduit, whose career he has followed with a lively interest.

Referring to the book, Professor Blondel says that, avoiding general or theoretical electrotechnique, the author has devoted attention to detailed study of practical means of applying theory in actual machines. He has produced a personal work in which he has presented clearly and directly the essential elements of each theory, that which is directly applicable. In many cases he is the first to combine in a new arrangement elements which thus associated have double value for those who wish to apply them. He has added many remarks and counsels inspired by his own experience.

Among the new subjects treated in the present edition, Professor Blondel draws attention to the important advances in the theory of continuous-current dynamos, in which Professor Mauduit is an expert on commutation. There is no work where the study of commutation is treated so exactly and on such a solid experimental foundation. Noteworthy are the treatment of non-sinusoidal currents, magnetic fields in alternating-current machinery, three-phase transformers and practical calculations of induction motors.

The author has also made a new development in the study of synchronous machines in giving a place to the theory of double reaction. He introduces also questions relative to the short-circuiting of alternators and the coupling of alternators with dampening circuits.

In the study of alternating-current motors with collectors he has unified the theory of the different types, notably in that which concerns the study of resultant flux, commutation and saturation. Space has also been given to mercury-vapor converters, dynamos with three brushes, and so forth.

One sees, says Professor Blondel, that the new edition is almost a new work. Like its predecessors, it constitutes for the electrician-engineer a veritable encyclopedic manual on the construction and utilization of machines in which the reader, young or old, will find the necessary elements for making quick application of recent progress, at the same time that numerous subjects for reflection and study are suggested to him. H. H. NORRIS.

The Dynamo—Its Theory, Design and Manufacture

By C. C. Hawkins, Vol. I, sixth edition, rewritten and enlarged. Bath, England: Sir Isaac Pitman & Sons, Ltd. 505 pp., illustrated.

The English type of text differs largely from the American and is chiefly meritorious for the accuracy and thoroughness of its treatment. While English books are not making serious encroachments in the schools as classroom textbooks, they are universally respected and consulted by teachers and students.

The present revised volume is an admirable work on the fundamentals of direct-current and alternating-current generators. It discusses these machines from the design viewpoint very largely, but also gives valuable pointers on manufacture and operation. The author uses mathematics and vectors to determine quantitative results and bases his design analysis on the mechanical-force equation instead of the familiar induced-voltage relations. The book is particularly noteworthy in its consideration of mechanical forces associated with machine operation. It is a welcome revision to a well-known text and its technical treatment is greatly improved over past editions.

Books Received

Hochfrequenzmesstechnik. By Dr. Ing. August Hund. Berlin: Julius Springer. 326 pages, illustrated.

Principles of Electric Spark Ignition in Internal-Combustion Engines. By J. D. Morgan. London: Crosby, Lockwood & Sons. New York: D. Van Nostrand Company. 92 pages, illustrated.

Theoretical and Practical Electrical Engineering. By Louis Denton Bliss. Takoma Park, Washington, D. C.: The Bliss Electrical School. Vols. I and II. 761 and 708 pages respectively, illustrated.

Depreciation of Public Utility Properties. By Henry Earle Riggs. New York: McGraw-Hill Book Company. 211 pages.

Die Wissenschaftlichen Grundlagen der Elektrotechnik. By Dr. Gustav Benischke. Berlin: Julius Springer. 682 pages, illustrated.

Ultraviolet Radiation. By M. Luckiesh. New York: D. Van Nostrand Company. 258 pages, illustrated.

Radio for All. By H. Gernsback. Philadelphia and London: J. P. Lippincott Company. 292 pages, illustrated.

Lehrbuch der Physik. Vol. II. **Magnetismus Elektrizitat.** By E. Grimsehl. Leipzig and Berlin: B. G. Teubner. 780 pages, illustrated.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Fire Causes Half-Million Loss at Eagle Rock

The Eagle Rock substation of the Southern California Edison Company was partly destroyed by fire on Monday last, Jan. 8, entailing a loss unofficially estimated at $500,000. The fire, which burned for nearly eight hours, is said to have been caused by the explosion of a 60,000-volt lightning arrester, the flames quickly spreading to a quantity of oil stored in the substation.

Big Mining Contract Signed in Illinois

To the Central Illinois Public Service Company has just been awarded what is said to be one of the largest, if not the largest, coal-mine electric power contracts in the history of the industry. This took place when a contract was signed between this company and the old Ben Coal Company, operating several large mines in Franklin and Williamson Counties, Ill. The Old Ben Coal Company mines and ships 6,000,000 tons of coal a year. The contract with the coal company is for a period of ten years and its bill for electrical energy will be $500,000 a year. The Central Illinois Public Service Company will begin to serve the mines on Feb. 1. The coal company plans to electrify the remainder of its properties gradually over the next two years, so that by Jan. 1, 1925, the electricity required will aggregate 750,000 kw. When the mines of the Old Ben Coal Company are connected to the Central Illinois Public Service Company's lines there will be an aggregate of seventy-three mines operated by electricity supplied by this company.

New York State Commission Pleads Its Case

The annual report of the Public Service Commission of New York State to the Legislature, just made, declares it of great importance to the public welfare and comfort of the people that the public utilities over which the commission has jurisdiction should remain under the close observation of the state government and that ample power of regulation should at all times be vested in some adequate governmental agency, thus taking direct issue with Governor Smith's views.

"The establishment of a single regulatory commission by the Legislature of 1921, in place of two commissions, centered responsibility for regulation of utility operations," says the report. "The centering of responsibility for the regulation of all utilities of a like character was an act of wisdom and has been amply justified by the results of the work of the commission during the year just closed."

The eighty-one Republican Assemblymen, in a secret conference, agreed, to a man, according to Speaker Machold, their leader, to stand together in their action on measures proposed by Governor Smith and the Democrats, who control the Senate and have sixty-nine votes in the Assembly. This pledge is reported to include opposition to the Governor's program of "home rule" and municipal control or ownership of utilities.

San Francisco Cable Laid at Rate of 3 Miles an Hour

The Great Western Power Company's submarine power cable across San Francisco Bay referred to in last week's ELECTRICAL WORLD, page 56, as one of the largest and longest ever installed, was successfully laid last Monday, Jan. 8. The cable, which is more than 7 miles in length, was laid in one piece and in one continuous operation in the remarkable time of two hours and thirty-seven minutes, or an average speed of more than 3 miles an hour.

Power to Order Extensions Denied Commission

A decision denying the power of the Wisconsin Railroad Commission to order extensions of water mains has been handed down by Judge George Thompson of the Dane County Circuit Court in a suit growing out of an action of the state against the Washburn Water Works Company. The decision, far-reaching in effect, is thought virtually to nullify the right of the commission to order public utilities of other kinds to make extensions, as has been its custom during a long period of years.

"The jurisdiction of extension of water mains in cities rests with the municipality," Judge Thompson said, and he expressed the opinion that, though the Railroad Commission can review the action, the grant of original jurisdiction to the municipality in such cases is clear and specific under the law.

The court's opinion, it is contended, will have state-wide effect. Heretofore it has been though obligatory for utilities to do the bidding of the commission when extensions of such nature were ordered.

Bacharach Utilities Bill to Come Up Again

Representative Isaac Bacharach of New Jersey intends to continue to support in Congress his bill to prevent public utility corporations from appealing to the United States courts from rate decisions of state public utility commissions until after they have exhausted all their right of appeal to the courts of the state.

That is the crux of a letter Congressman Bacharach sent this week to Governor-elect George S. Silzer of New Jersey in reply to a letter from the latter urging him to drop his own bill in favor of one prepared by the Governor-elect which is described as "not so broad." Mr. Bacharach intimated that if his own bill is rejected on the claim that it is unconstitutional he will then urge the adoption of the Silzer measure.

Mergers of Wisconsin Utilities Continue

Control by the Wisconsin Public Service Corporation of Milwaukee of all power plants and service in the northern section of Manitowoc County has resulted from its acquisition of the Oslo Light & Power Company. This purchase followed another under which the Public Service Corporation came into possession of the lighting plant at Mishicot and the plant at Denmark, Brown County, just over the Manitowoc County line. The Reedsville property was acquired some time ago. The Oslo company, with 80 miles of line, serves the city of Kiel and nine villages.

With the acquirement of these plants the Public Service Corporation gains virtual control of the entire northern section of the state, it having also taken over a plant at Oconto, while it is serving the Lake Shore district north from Manitowoc. It maintains a steam plant in Manitowoc as an auxiliary to its High Falls hydro-electric plant and also operates a station at Green Bay.

Coincident with the confirmation of these purchases by the Public Service Corporation came announcement of the sale of the Cleveland (Wis.) municipal electric plant to the Badger Public Service Company, which was later taken over by the Milwaukee Electric Railway & Light Company.

That control of public utilities of the state may soon be vested in one or two big companies is indicated by the reports of transfers and mergers which have taken place in all sections in the past year.

Wired Radio Broadcasting

Practicability Is Shown by Recent Tests at New York City and Washington

TESTS of wired radio broadcasting have for several months past been conducted by the North American Company—in New York City in co-operation with the United Electric Light & Power Company, and in Washington, D. C., in co-operation with the Potomac Electric Power Company. The tests formed a practical demonstration of the feasibility of the "wired wireless" method.

In New York communication was established between the Sherman Creek and Hell Gate power stations over the 13,000-volt underground cables. The transmitting apparatus was connected to the high-voltage bus at Sherman Creek through the distributed capacity of a 30-ft. length of lead-covered cable. The receiving apparatus at Hell Gate was connected through the capacity between the primary and secondary windings of a potential transformer, one terminal of each being disconnected, the remaining terminals connected to the high-voltage bus and the receiving apparatus respectively. The wave lengths employed were in the neighborhood of 5,000 m., or 60,000 cycles per second.

In Washington broadcasting was conducted as such over the 2,400-volt, three-phase distribution system from the Georgetown and Tennallytown substations to the Bureau of Standards and to different points in Chevy Chase, D. C., and Maryland. Transmitter connection was effected through mica condensers, and the receiving apparatus was plugged into any convenient light socket. Wave lengths from 3,000 m., 100,000 cycles, to 30,000 m., 10,000 cycles, were employed. On every test reception from an antenna was compared to that over the light wires, and it was consistently found that unless the antenna was in very close proximity to the power lines, the limited radiation which was present at 3,000 m. decreased very rapidly with increasing wave length until it became unobservable at the lower frequencies. At the same time, owing to the decreasing attenuation from other causes with increasing wave length, for the same energy input considerably more energy was available at the receiving terminals.

Conditions of Experiments

R. D. Duncan, Jr., radio engineer with the North American Company, was in charge of the tests. Mr. Duncan in the issue of the ELECTRICAL WORLD for Aug. 19 last described certain experiments which had been performed in Cleveland with a view to investigating the practical utility of broadcasting by wired radio over electric lighting and power lines, the results of those experiments indicating, in his opinion, that, though requiring development, this new method of broadcasting not only offered a decided advantage over radio broadcasting but as a means of commercial use—as, for example, communicating over the high-voltage mains between substations and with repair crews, remote control of substations and similar functions—could be made of important service to electric lighting companies in general.

It is to be noted, Mr. Duncan said recently in describing the later experiments in New York and Washington, that the problem of wired radio broadcasting over an interconnected distribution network of a city differs considerably from similar operation over a long-distance, high-voltage transmission line. In the latter case there is a directly connecting, unobstructed path, constituted by the high-voltage conductors, between the transmitting and receiving stations. In the former the distribution network, constituting innumerable paths and to which are connected hundreds of transformers and other forms of power apparatus, besides a multiplicity of receiving sets, forms the interconnecting medium. It is obvious that the attenuating effect of such a network on the high-frequency currents is many times greater than with a high-voltage transmission line.

Furthermore, Mr. Duncan continued, since one of the fundamental objects of this new type of transmission is to suppress or eliminate entirely radiation from the lines, with the consequent interference with radio broadcasting—already in a chaotic condition—the construction of a large outdoor aërial in close proximity to the high-voltage lines and for coupling thereto is, where the latter are overhead, precluded from the start, and of necessity direct connection to the system must be effected in the power house or substation. This is especially true when the distribution system is underground, as is the case in most cities. Connection to the buses in the substation immediately brings up a multitude of problems, such as the effect of attached apparatus, induction voltage regulators and so forth, all of which, it has been found, vitally affect the high-frequency transmission.

Results Ascertained

The effect of connecting transformers across the lines has been investigated, and their characteristics at high frequencies have been determined. The same is being done with induction voltage regulators which contain both a shunting and series winding.

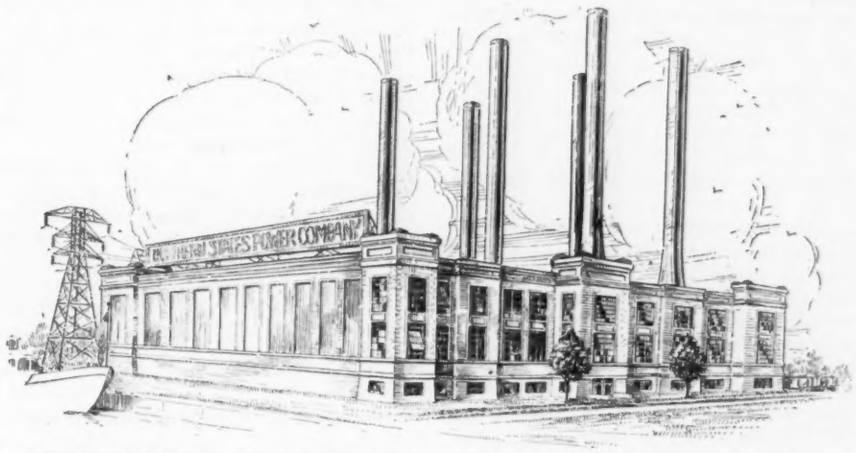
Another interesting line of investigation has been that of relay operation at high frequencies. Remote control of relays has been obtained by voice modulation and whistling at the transmitter, the relay being adjusted to respond to voices at different pitch and to different types of modulation.

Mr. Duncan acknowledges the co-operation of H. R. Searing of the United Electric Light & Power Company and J. H. Ferry of the Potomac Electric Power Company.

St. Paul's New Power House

Further Details of the Eighty-Million-Dollar Program for the Twin Cities

AS ALREADY stated in the ELECTRICAL WORLD, the H. M. Byllesby Engineering & Management Corporation has announced a hydro-electric and steam-power construction and development program for the cities of Minneapolis and St. Paul which will involve the expenditure of $80,000,000 in the next ten years. This new construction will increase the generating capacity of the Northern States Power Company is 303,000 hp.



PROPOSED 100,000-HP. ST. PAUL PLANT OF THE NORTHERN STATES POWER COMPANY

Construction work on a 100,000-hp. steam-turbine generating station in St. Paul on the Mississippi River near High Bridge will start immediately. The first generating unit to be installed will have 40,000-hp. capacity, and it is planned to install additional capacity of 60,000 hp. after this unit is completed. During the remainder of the ten-year period an additional steam generating capacity of about 100,000 hp. will be added, divided between the Riverside station in Minneapolis and the new power plant at St. Paul. The present capacity of the Riverside station is 103,000 hp., of which about 28,000 hp. is generated by water power and the rest by steam.

Hydro-electric development on the St. Croix and the Upper Mississippi Rivers has been authorized by the Federal Power Commission. Construction plans call for an increased capacity of 106,000

hp., which will be divided between the existing plant and new construction. A water-storage dam will also be built in the St. Croix River, 8 miles above the Kettle River Rapids.

To facilitate the distribution of this additional power, a new transmission loop will be built around the Twin Cities, with the necessary additions in substations and other equipment. The financing plans contemplate the continuance of customer-ownership methods which have created a shareholders' list of about twenty-five thousand persons, most of whom are customers of the company.

North Americans Elected to Brazil Technical Club

One of the results most hoped for from the International Engineering Congress in Rio de Janeiro was the establishment of closer relations between the engineers of the Americas. A tangible proof that this has resulted is seen in the election of the following North American engineers to membership in the Club de Engenharia, an organization which would correspond to an amalgamation of the four national societies here in the United States of North America:

Elected corresponding members: Josiah E. Spurr (A. I. M. and M. E.), editor *Engineering and Mining Journal-Press;* Louis J. Hirt (A. S. M. E.), engineer Pearson Engineering Corporation.

Elected honorary members: Verne L. Havens (A. S. C. E.), director *Ingeniería Internacional;* A. W. K. Billings (A. S. C. E.), Canadian & General Finance Company, Ltd. (Toronto); Edward Wegmann (A. S. C. E.), consulting engineer; Samuel M. Vauclain. (A. S. C. E.), president Baldwin Locomotive Works; Calvin W. Rice (A. S. M. E.), secretary A. S. M. E.

Puget Sound Company Gets Coast Utilities

The Puget Sound Power & Light Company, Seattle, Wash., has purchased the Washington Coast Utilities, furnishing lighting and power service in Wenatchee, Edmonds, Arlington, Stanwood, Vashon Island, Port Townsend and Montesano. The combined properties will be under the management of Stone & Webster, Boston, who have managed the Puget Sound company for more than twenty years. An adequate source of energy for the development of the fruit-raising districts of central and western Washington will result from the completion of a 120-mile transmission line now being built by Stone & Webster, from the White River hydro-electric plant over the Cascades to Wenatchee.

The gross revenue of the acquired company reaches approximately $700,000. The capitalization is about $3,000,000, of which one-third is in common and preferred stock. The Puget Sound company is purchasing $500,000 par value of common stock for cash and securities, offering to exchange its 6 per cent preferred stock share for share for the preferred stock of the Washington Coast Utilities, of which about five thousand shares are outstanding.

Kentucky Utility Favors Mouth-of-Mine Plants

Officials of the Kentucky Utilities Company are much pleased with the rapid development of the company's high-tension transmission lines in western Kentucky, where it now has nearly 200 miles of lines. The company had a contract whereby it gets the surplus power of two 6,000-kw. coal-mine plants at Greenville and Earlington, amounting to from 5,000 kw. to 5,500 kw. These plants are at the mouth of the mines and furnish power from coal chuted to or directly dumped on the stokers.

In fourteen months the company has developed a total transmission system of 92 miles in western Kentucky and it now furnishes service to a large number of towns, mines and farms in that part of the state. In eastern Kentucky the company has 215 miles of interconnected transmission lines and close to 500 miles in all. In the Harlan County field alone there is about 21,000 kw. connected load.

The company is to a considerable extent following out the plan of producing power at the mouth of the mine. Just how big the development of this method will be is uncertain, but the utility is steadily enlarging its system and there is rapid growth of demand, especially in the eastern Kentucky coal fields.

Alabama Power Company Completes Mitchell Dam

On the first day of January the Alabama Power Company plugged Mitchell Dam, and the ceremony marked the completion of the eight-million-dollar water-power project. As the impounded waters flow down from Lock 12 they will create a lake 14 miles in length, the entire distance between the two dams.

The first unit of this new project, carrying 25,000 hp., will be placed in operation in February. By April two more units of 25,000 hp. each are expected to be placed in operation, and the total harnessed power of the dam at that time will be 75,000 hp. When the last unit is placed in operation the total horsepower produced will be 120,000.

The Alabama Power Company will begin the construction of its next large water-power project, on the Tallapoosa River, early this year. Four dams will be constructed, and the potential development of power is about 140,000 hp. The project, it is said, will cost between twelve million dollars and twenty million dollars.

Henry Ford's Water-Power Project at High Dam

According to a press dispatch from St. Paul, representatives of Henry Ford, who, as told in the ELECTRICAL WORLD of Dec. 30, page 1465, is endeavoring to obtain from the Federal Power Commission the right to the power produced by the High Dam erected by the government in the Mississippi River between St. Paul and Minneapolis, have announced the purchase of a site for the proposed factory of the Ford Motor Company immediately adjacent to the dam and have given out the statement that if the water-power rights are granted a ten-million-dollar plant, to employ ultimately between fourteen and fifteen thousand men, will be built; otherwise a plant on a smaller scale to be operated entirely by steam is projected.

Senator Nelson of Minnesota has, it is reported from Washington, aligned himself with those opposed to granting these power rights to the Ford company.

Information from political circles in Minnesota is to the effect that the Legislature will not grant the Municipal Electric Corporation the authority necessary to carry out its plan for the utilization of the High Dam. There is a very general opinion, however, that the Legislature will extend the authority of the Warehouse and Railroad Commission so as to give it regulatory supervision over power matters.

Competitor Allowed to Enter Indianapolis Field

A certificate of convenience and necessity has been granted by the Indiana Public Service Commission to the Terre Haute, Indianapolis & Eastern Traction Company, which has made plans for an eventual expenditure estimated at between $6,000,000 and $7,000,000 in the development of the West Tenth Street power plant in Indianapolis and in the construction of transmission and distribution lines inside and outside of Indianapolis. As previously reported in the ELECTRICAL WORLD, the application of the railway company was contested by both Indianapolis power companies, the fight being called one of the most bitter in the history of the commission.

The opinion handed down with the order challenges the idea that regulated utility monopoly is best under all contions and asserts that there are situations in which the public will be best served by a certain amount of competition. It denies that a public utility has any vested right in a monopoly and affirms that the basis for regulated monopoly is the public welfare and not the welfare of a utility company.

Although the certificate gives the company authority to supply electrical energy for all purposes authorized by law, a representative of the railway company said that the intention for the present is to sell power in bulk and not to distribute power to small Indianapolis consumers.

Federal Engineer on Power in Southeast

After a trip along the Coosa and Tallapoosa Rivers and a visit to Muscle Shoals and to the Gorgas steam plant, Col. William Kelly, the chief engineer of the Federal Power Commission, has returned to Washington much impressed with the rapidly growing market for power in the Southeast. Colonel Kelly is interested in the possibility of utilizing storage on the Tallapoosa to advantage. There are several sites on that stream where large storage can be provided at low cost. This would prove an important supplement to the Coosa River plants since it would help the Alabama Power Company to carry its base load on water power.

Further relief could be had, Colonel Kelly reports, if the Alabama Power Company could secure a long lease on the Sheffield plant. As it is, 30,000 kw. of that plant's capacity cannot be used because of transmission-line limitation. It would cost $750,000 to provide the additional transmission line, an expense which the Alabama Power Company naturally would not incur when the contract for the use of the plant is subject to termination on thirty days' notice. Colonel Kelly says that two thousand yards of concrete are going in every day at Muscle Shoals. Construction work has reached the point, he believes, where no slackening of the work will be caused by high water.

New Rates for Great Western Power Company

Rates reflecting a reduction of approximately 10 per cent on the system as a whole have just been established for the Great Western Power Company by the California Railroad Commission. The rates are almost identical with the new rates of the Pacific Gas & Electric Company, referred to in the ELECTRICAL WORLD for Jan. 6, page 56, and as in the case of the latter are entirely new, taking the place of existing rates and surcharges. The rate structure eliminates various discriminatory rates, and for that reason the percentage reduction is not uniformly applicable to all present charges. Flat rates are effective Feb. 1, meter rates Feb. 20.

Lighting rates in San Francisco and contiguous places will be 90 cents per meter a month for the first 10 kw.-hr., 6 cents for the next 40 kw.-hr., 5 cents for the next 150 kw.-hr., with proportionate reductions as consumption increases. In other incorporated places the rate schedule starts at $1 a month, and outside of incorporated limits it begins at $1.25.

In general the same principles of valuation and rate making were applied to the Great Western as to the Pacific Gas & Electric. The application of these principles eliminated the company's claim of $15,000,000 for water diversion rights and $8,047,185 for development costs. Other reductions were: Intangible capital from $277,359 to $189,500, lands from $4,540,229 to $1,353,022, structures from $40,713,903 to $36,740,957, working capital from $938,049 to $590,000. For additions and betterments operative in 1922 $1,271,000 was allowed.

The rate base found reasonable is $40,144,479. Including items eliminated, the company claimed a rate base of $69,516,725.

Valuation of Idaho Power Company Cut in Half

After a hard-fought battle of more than two years' duration, the Public Utilities Commission of Idaho has placed a value for rate-making purposes of $11,638,495 upon the property of the Idaho Power Company. The original valuation arrived at by the company's representatives was $22,567,890, but the commission's elimination from the inventory of eighteen Idaho items and one Oregon item on the ground that they are "non-co-operative," the omission of cost involved in borrowing money for development, the discarding of "capitalized deficits," the reduction of alleged inflation in purchase prices, with other "slashes" made by the regulating body, brought the sum total down to the figure already named. Even of this greatly reduced total the commission decided that $1,542,095 is not entitled to full return.

The formal order of the commission which accompanies the opinion sets Monday, Jan. 22, as the date for the opening of the hearing concerning the rates to be based upon the new valuation just arrived at.

New York Utility Offers Stock to Customers

Consumers and Employees of Consolidated Gas Company and Its Affiliated Companies May Buy 6 per Cent Preferred Issue at Par, with Privilege of Resale at Premium

DETAILS of the special offer of 6 per cent cumulative participating preferred stock of the Consolidated Gas Company offered at par ($50 a share) to its employees and those of its affiliated companies and to all consumers of gas or electricity distributed by it and its subsidiaries have just been published over the signature of George B. Cortelyou, the president. The authorization of this issue was referred to in the ELECTRICAL WORLD for Dec. 2, but full particulars were not then available. The New York Edison Company, the United Electric Light & Power Company and the New York & Queens Electric Light & Power Company are among the affiliated companies of the Consolidated Gas, and their employees and customers share in the invitation.

This stock will be entitled to receive additional dividends at the rate of 1 per cent for each dollar a share paid on the common stock in excess of the rate of $4 a share per annum. It is designed for those consumers and employees who are seeking an opportunity to invest their savings safely, with the further advantage that it may be acquired by installment payments.

One of the purposes of this issue is to obtain the widest possible range of ownership of this company's stock by consumers and employees, the hope being that eventually every consumer and every employee will become a stockholder, thus assuring a sympathetic relationship between the company and its affiliated companies and the public which they serve. For the purpose of assuring the permanency of this plan of widely distributed ownership, the company has established a means through which any holder desiring to sell his shares may find a constantly available market at a premium above the price paid. This redemption provision is in part as follows:

"In case any holder of preferred stock shall at any time desire to sell or otherwise dispose of any of such preferred stock, he shall give written notice thereof to the company at its main office; and the company shall have the right, within thirty days after the receipt by it of such written notice, to purchase the preferred stock described in such notice upon the payment of an amount equivalent to the par value thereof and the amount of any unpaid dividends accumulated thereon to the date of purchase, plus a premium equivalent to 5 per cent of such par value if dividends of not exceeding 6 per cent in the aggregate shall have been paid on the preferred stock during the period of twelve consecutive calendar months next preceding the purchase thereof; a premium equivalent to 10 per cent of such par value if dividends exceeding 6 per cent but less than 8 per cent in the aggregate shall have been paid thereon during such period, or a premium equivalent to 15 per cent of such par value if dividends of 8 per cent or more in the aggregate shall have been paid thereon during such period. . . . No preferred stock shall at any time be transferable by any stockholder unless he shall first have given the said written notice to the company nor unless the company shall have either consented in writing to such transfer or shall have failed to exercise its right to purchase the said stock within thirty days after the receipt by it of the said written notice."

The new issue may either be paid for in full upon allotment or payments may be spread over a period of ten months, interest being credited on the payments at the rate of 5 per cent. Consumers so desiring may make such payments with their monthly bills.

An over-subscription is anticipated, and the company therefore reserves the right to decline subscriptions in whole or in part and to make individual allotments in such manner as may seem best.

Engineering Education Is a Fruitful Theme in Many Quarters

Prof. C. F. Scott Pleads for Fuller Comprehension and Support

A BETTER understanding of the purposes of engineering schools, financial support for their work, more intelligent guiding of potential engineering students in secondary schools and a clear recognition of the complex tasks of technical education were urged by President Charles F. Scott of the Society for the Promotion of Engineering Education in a paper upon "Engineering Training and Modern Life" presented at the recent Boston meeting of that society and of the American Association for the Advancement of Science. Reviewing the development of applied science in the past century, Professor Scott pointed out that the engineering type of mind is destined to assume general leadership in governmental and public affairs as well as in private industry. The stability of our civilization depends on our ability to produce the man power for successful and technical leadership. In concluding his address Professor Scott, who holds the chair of electrical engineering at Yale University, said:

"Broader fields of service call for broader training. Suggestions come to the schools from all quarters proposing supplemental subjects which would make the college curriculum cover a lifetime. What is the best training for the young engineer which will best fit him for leadership? Are the present facilities in our engineering schools, their curricula, their equipment, their faculties, their environment, those which will best train young men for the needs of the future? Are boys in sufficient number and of the right type entering those courses?

The Common Factor

"If engineering education is to provide men for such divergent activities as technical research and design, construction, salesmanship, finance, management and advertising, one may well question what is the common factor in all these things which constitutes the real engineer. Is the product of the engineering school to be a definite, simple thing, or is there to be an indefinite list of engineering courses varying from sanitary and automobile engineering to commercial and human engineering? Is the engineering course to be one thing or an indefinite number? Is there some class or type of boys who will make good engineers or is the engineer himself so varied that any sort of a boy ought to make some sort of an engineer?

"In general we recognize that the common factor in the varied type of engineer is a common method; this may be applied to different kinds of problems in accord with personal tastes and abilities and with opportunities and needs.

"Broadly the purpose of the engineering schools is to produce men who will do their part in the world's work. But in order to produce a definite product there should be a definite ideal. Should these matters lie only with the engineering school, with the authorities who select the faculties and with the faculties who make schedules of studies and impart ideas?

Clear Objective Needed

"Surely we need to know more clearly the ideals and objective in engineering education. The prime task will presumably fall to the engineering school. It must survey the situation and take counsel from others as to the real needs of the future and then set about to determine what training and what learning and what influences will best contribute to the desired results. But as the problem in its larger sense is one which vitally concerns the industries and the public utilities and, broadly speaking, the public welfare it is fitting that there should be a wider interest in the problem. There are other things besides advice which the schools need. There should be a better understanding of what engineering means. High schools and preparatory schools now have teachers with a decidedly academic influence. These should take a new attitude toward the engineering school and the selection and direction of boys of better quality to it. Financial support should be forthcoming. A better understanding is needed of what the graduate is and what he can do. He has potential ability, he has fundamental training, he is a good beginner, but he must have opportunity for experience and training and growth in the particular fields which he enters. These are matters in which those outside the engineering school can contribute directly toward the production of the engineer of the future."

Stratton Tells of Need of Trained Men

Informally addressing the student body of the Massachusetts Institute of Technology in taking office as president at Cambridge last week, Dr. S. W. Stratton declared that there never was a greater shortage of well-trained men than today and emphasized the growing bond between American manufacturers and institutions of learning, saying that it marks a trend toward closer cooperation in future on behalf of scientific and commercial progress. Dr. Elihu Thomson, acting president, occupied the chair. Prof. H. P. Talbot greeted the new president on behalf of the faculty and Robert Payne Shaw spoke on behalf of the undergraduates. Dr. Stratton said that a few years ago an ordinary manufacturer would not come near a university, but that that time has fortunately passed away and the universities are now besought to aid in solving the problems of industry.

President Butler Says High Standard at Columbia Will Be Kept

PRESIDENT NICHOLAS M. BUTLER of Columbia University, New York, in his annual report to the trustees, says that opinion is moving in the direction of a policy of higher standards of admission and instruction in engineering schools. The time has come, in Dr. Butler's opinion, to give more special and concentrated attention to the advanced and research work of the university in the whole field of engineering. "The line of separation between pure and applied science is increasingly difficult to discern and maintain." Dr. Butler says, "The real distinction would appear to lie not so much in the subject matter as in the spirit with which the work of research is carried on."

The policy of Columbia University in accepting eight years ago the recommendation of the faculty of applied science to elevate the standard of admission to the Schools of Mines, Engineering and Chemistry, and to turn those schools definitely to the task of training leaders of the engineering profession and research workers, has resulted, Dr. Butler asserts, in greatly reducing the enrollment of students and has left several departments of instruction overequipped for the work which they have to do, at least during the period when the new policy is establishing itself; but he thinks that no one would counsel going back to the former policy of accepting students for the Schools of Mines, Engineering and Chemistry direct from the secondary schools.

Principles Are Determined

"That," he says, "would be to abandon a fixed principle of our university organization and development and to turn aside from a task which but few institutions, among them Columbia, can do at all, to resume the task which almost any institution of higher learning can accomplish if it chooses. The real question under discussion would appear to relate to the details of the existing plan of admission and instruction, and not to the principles upon which that plan is based. There are signs that opinion is moving in the direction of the policy that was adopted eight years ago."

Pointing out that a group of representatives of the most important engineering schools in the Middle Western States have unanimously approved a five-year program of study for engineering students, with a view to giving the time gained to the study of the humanities and fundamental scientific subjects, Dr. Butler says that whether the program of engineering study be one of five years or six years is probably of less importance than its content and the possibility of the funda-

mental instruction being given by a large number of colleges and scientific schools.

Industrial Lectureship at Princeton Succeeds

An attempt to bring students into direct contact with the activities of the engineering world and to acquaint them with the leading personalities in industry has been very successful at Princeton University.

In 1921 the Princeton Engineering Association established the Cyrus Brackett Fogg lectureship in memory of Dr. Fogg, formerly professor of physics and electrical engineering at Princeton. A series of lectures is given during the college year by eminent engineers and scientists. These lectures are chosen by an alumni committee in co-operation with Dean Arthur M. Greene, Jr.

Last year the speakers were Samuel Insull, Joseph B. McCall, John W. Liéb, Charles L. Edgar, John A. Britton, Dr. N. E. Loomis and Col. William C. Spruance. Lecturers for this year are Charles E. Adams, Dr. Ralph Modjeski, Henry I. Harriman, Dana D. Barnum, R. G. Porter, Henry O. Loebell, Alexander S. Lyman, August Belmont and General J. J. Carty.

Dean Greene reports that large numbers have attended the lectures and that the students have shown great interest. The plan marks a trend in development which should, it is held, have a marked influence upon educational co-operation with industry.

No Successor Found for Dr. Stratton at Washington

No progress has been made in the search for a director for the Bureau of Standards to succeed Dr. S. W. Stratton, who retired from the government service to accept the presidency of the Massachusetts Institute of Technology. Because industry is making much more extensive use of research laboratories, physicists are, according to Commerce Secretary Hoover, very scarce and as a result the level of salaries has risen greatly. This, he declares, makes it very difficult for the government to find an ideal man for this place, when it requires a physicist in the front rank of his profession who will be willing to work for $6,000 a year.

Wiring Committee Makes Recommendations

In an interim report the wiring committee of the Joint Committee on Business Development has made the following recommendations as a "standard or measure at which commercial departments, wiring contractors, etc., should aim." The committee labels its recommendations "the minimum American house-wiring standard of wiring outlets." They are:

"An average of three outlets (lighting and convenience) per room [that is, parlor, sitting room, dining room, kitchen, bedroom, etc., as based on the ordinary real estate rating], computed as follows:

"There should be at least one lighting outlet and one convenience outlet in any one room, and the outlets (whether lighting or convenience outlets) in the bathrooms, hallways, stairways, closets, unfinished attics, cellars, etc., and any additional outlets in the main rooms (over and above the minimum of one lighting and one convenience outlet) should be enough to bring the average per room up to three as a minimum.

"For the purpose of this standard a switch is not an outlet. An outlet (omitting switches) is considered the point where the wires come to an end at the wall. A convenience outlet is considered as one outlet. A twin convenience outlet permanently connected to the wall is considered as two outlets. A bracket light is considered as one outlet even if there are two or more sockets in the bracket. A chandelier is considered as one outlet even if there are two or more sockets in the chandelier."

Interstate Merger Approved

The application of the Interstate Public Service Company of Indianapolis for permission to absorb seven public utilities owned by it or under the same control has been approved by the Indiana Public Service Commission. The consolidation is based on a $6,071,029 valuation, and the commission has authorized the company to issue $2,000,000 common stock, $600,000 of 7 per cent preferred stock and $500,000 of 5 per cent bonds to finance the deal and to assume $2,119,600 of debts against the absorbed properties. The seven companies are the Hydro-Electric Light & Power Company, Connersville; Hawks Electric Company, Goshen; Middlebury Electric Company, Winona Electric Light & Water Company, Electrical Transmission Company of Northern Indiana, Southern Indiana Power Company and Indianapolis & Louisville Railway Company.

The enlarged Interstate Public Service Company serves more than 46,000 customers with electricity and has an annual gross revenue from all sources of approximately $6,000,000.

December Financing Less Active

ALTHOUGH the demand for bonds during the month of December was not so heavy as it had been for several months previously, bond dealers report that the issues offered were well absorbed by investors. New issues of electric light and power public utility securities equaled $18,048,000. The issues were small in number and also in volume. Only nine issues of this type of security were offered in the month, and the largest single offering was the five-million-dollar stock issue of the Electric Bond & Share Company. The average rate of return yielded the investor advanced to 6.59 from 5.82 in November and 5.85 in October. The fact that most investment bankers decided to stand aloof from the market until the first week of the new year tended to slow up business, but the outlook for new issues is now pending.

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN DECEMBER

Name of Company	Amount of Issue	Period	Class of Security	Purpose of Issue	Rate of Interest	Offered at	Per Cent Yield
Central Indiana Power Co.	$4,248,000	Twenty-five-year	First mortgage collateral and refunding gold bonds, series A.	To acquire securities of subsidiary companies and for other purposes	6	95	6.40
Central Arizona Light & Power Co.	500,000	Twenty-year	First and refunding mortgage gold bonds, series B.	To retire outstanding bonds	6	97	6.25
Great Northern Power Co., Ltd. (Ontario)	850,000	Fifteen-year	First mortgage sinking-fund gold bonds.	To construct plant	7	95*	7.50
Adirondack Power & Light Corp.	2,500,000	Twenty-eight-year	First and refunding gold bonds		5½	96¾	5.75
	3,800,000		Cumulative preferred stock	For acquisitions and construction	7	90	7.78
Detroit Edison Co.		Ten-year	Convertible gold debenture bonds.		6	102	5.73
Northern Ohio Traction & Light Co.	1,000,000	Twenty-five-year	General and refunding mortgage gold bonds, series A	To retire underlying bonds and reimburse for construction expenditures	6	94	6.50
Coast Power Co. (Oregon)	150,000	Twenty-year	First mortgage bonds, series A.	To retire outstanding bonds and for additions	6	98	6.20
Electric Bond & Share Co.	5,000,000		Cumulative preferred stock	General corporate purposes	6	97	6.20
Total	$18,048,000						

* With a bonus of 50 per cent in common stock.

Farm Engineers Form Rural Lines Committee

The use of electrical energy on the farm was discussed at the annual meeting of the American Society of Agricultural Engineers at St. Louis at a session of the college section on Dec. 27. The matter was presented by J. C. Martin of the ELECTRICAL WORLD as one in which the electrical and agricultural industries must co-operate. Methods and equipment through which the farmer can employ electrical energy profitably to reduce the cost of production must be developed, Mr. Martin said.

Men engaged in farm engineering work at the agricultural experiment stations and who make up the college section of the society discussed the problem, dwelling on the important part these stations should take in its solution. A committee to study rural electric service from central stations was formed to supplement the work already under way by a committee studying the individual-plant problem. C. A. Atherton, National Lamp Works, Cleveland, is the chairman of the new committee.

Coal Commission May Take Hand in Wage Dispute

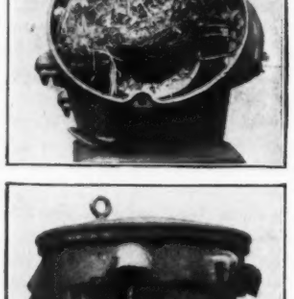
The action of the President's fact-finding coal commission last week in telegraphing the officials of the coal operators' and miners' joint wage conference at Chicago asking for a continuance of the present wage scales for one year in case efforts to reach an agreement should fail is thought by some to indicate a disposition on the part of the commission to mediate in the wage dispute. The commissioners have asserted the probability of an agreement of some kind that will prevent a strike on April 1. The replies from Chicago afford basis for a moderate degree of optimism, both sides, while maintaining that the agreement proposed could not be made at the conference then in session, expressing the opinion that a subsequent conference would be held at which it could be acted upon.

Accounting Service Given by Wisconsin Association

The Wisconsin Utilities Association has instituted an accounting service bureau for the purpose of assisting the smaller member companies in the association to keep better accounts. Karl F. McMurry will head the bureau. By going to Madison to have reports made out, errors in accounting detected or general instruction given to new bookkeepers, companies can obtain this service without extra charge. The smaller companies can send in their records and federal and state income tax reports will be made out. In cases where more extensive services are required the member companies are expected to pay the actual cost.

Brief News Notes

A New Experiment in Electrical Homes.—Just as the electrical interests in Cleveland were opening their fifth "electrical home" with the latest electrical fixtures and appliances, a sixth electrical home, not quite so modern, but in the class of experiments, was discovered by linemen working on a 55-ft. pole in one of the districts where trees are not plentiful. A bushing in a transformer case, which insulated the primary tap from the casing, had in some way been ejected, leaving a 1½-in. opening through which the birds entered the case. Within it, over the coils,



five nests, built one on top of the other, were found, possibly used by the same birds for as many years. There was one egg in the top nest. The transformer had been in service for eleven years and was being replaced by a larger one. It was rated at 7½ kw. and was connected to a 4,600-volt primary line. This plan of partial electrical incubation seemed to have been successful, as there were no signs of fatalities to birds in the transformer case. The photograph was taken by W. C. Saker of Cleveland.

Cheboygan (Mich.) Company Sold.—The General Engineering & Management Corporation, New York City, has recently taken over the Cheboygan (Mich.) Electric Light & Power Company, serving twelve communities, and is completing negotiations for the acquisition of some properties in New Jersey.

A Consolidation in Maryland.—The plant of the Havre de Grace Electric Company has been purchased by the Northern Maryland Electric Company, and connections will be made at Perryville with the latter company's transmission line, which will be extended from Port Deposit, the end of its present line. Steel poles will be used.

Maine Companies May Unite.—The Cumberland County Power & Light Company, Portland, Me., has petitioned the Maine Public Utilities Commission for authority to purchase the properties of the York County Power Company and the Westbrook Electric Company. The Cumberland County company owns the common stock of these utilities, which form with it a single interconnected system.

New Turbine for Iowa Utility.—The Tri-City Railway & Light Company is contemplating the addition of a 26,000-kw. turbo-generator to its Moline station, at a cost of about $1,250,000. The present capacity of the station is adequate to take care of existing needs, but a careful survey has shown that the proposed new unit will be required in the next few years. The Moline station serves Davenport, Rock Island, Moline and Muscatine.

Permanent Electric Exhibit at San Diego.—In connection with a permanent materials exhibit now being installed in the basement of the Spreckels Building in San Diego, Cal., electrical men plan to take part of the space and make a co-operative display. Building permits for San Diego totaled $10,000,000 in 1922, and the prospects are for a still more active program in 1923. The exhibit will bring builders into contact with those who manufacture, job and retail materials and appliances.

Fort Smith Transmission Line Completed.—The transmission line of the Oklahoma Gas & Electric Company from Muskogee, Okla, to Forth Smith, Ark., has been completed. This line furnishes power to Fallis, Gore, Vian, Sallisaw, Hanson and other towns along the line which heretofore have been dependent upon small individual plants. The construction of this 60-mile transmission line through a wooded and mountainous country was completed in sixty-two days. A distribution system at Gore and Webbers Falls is now being constructed. The main construction force has been transferred to the southern extension, which will run south from Sallisaw through Cowlington, Poteau and Heavener. This line will extend into the coal fields of eastern Oklahoma.

Nevada Valleys to Lease Lahontan Plant.—It is reported that the Secretary of the Interior and the Director of the Reclamation Service have approved the contract entered into by the Nevada Valleys Power Company and the United States government for a lease on the Lahontan power plant. The lease is to extend from 1924 to 1934, and in return the company abandons all claims to power rights on the Truckee River near Vista. The contract provides for certain improvements to the Lahontan power plant, increased power efficiency and broadening of the power service. Approval of the contract settles for ten years the friction that has

developed over power rights on the Truckee River, involving as participants the Reclamation Service, the Nevada Valleys Power Company and promoters of the Newlands Project.

Electrification of Railroads in France.—Electrification of the section of the Midi Railroad from Pau to Tardes in France has been about completed. The Midi Railroad is committed to the electrification of 1,864 miles of track at an early date, and the Orléans and Paris-Lyons-Mediterranean lines have similar progress in view. The director of the Midi Railroad says that the electrified system will be extended to Montrejeau by March and that during the summer of 1923 the Dax-Toulouse line will be electrified.

Springfield (Ohio) Company to Serve Five Electrically Abandoned Towns.—Five Ohio communities that lost electric power and light service when the Springfield, Troy & Piqua traction line was abandoned will receive service in the future from the Springfield Light, Heat & Power Company, negotiations having been about completed. These communities are North Hampton, Dialton, Bushnell, Lawrenceville and Thackery. Under the tentative plan, the Springfield company will take over the transmission lines of the abandoned traction line, transmitting energy at 66,000 volts, to be reduced to 110 volts for consumption. The Springfield company is also supplying Urbana with light and power and contemplates extension to other communities in the vicinity.

Wakefield to Save Money by Buying High-Tension Central-Station Service.—By expending $50,000 for a new substation and for an underground line about 6,000 ft. long to connect with the system of the Edison Electric Illuminating Company of Boston, the town of Wakefield, Mass., will save about $7,000 a year over the present costs of operation. The town has a municipal distribution system and already purchases energy from the Edison company, but by the new arrangement electricity will be supplied to the town at the regular high-tension rate. The Edison company will expend $135,000 to build an underground line from its Woburn substation to the Wakefield town line, the distance being about 5 miles. The introduction of the high-tension service will also enable the town to expand its local service. The citizens have appropriated $50,000 for the foregoing purpose.

Court to Decide Utility Basis.—An order issued by the Corporation Commission of Oklahoma holding that the Southern Oklahoma Power Company, which manufactures electricity at Byng, is a public utility under the laws of Oklahoma is to be tested in the State Supreme Court. The question involved is whether or not the company is required to report to the Corporation Commission and file all the reports required under the commission's orders. The commission holds that the ownership of the Southern Oklahoma Power Company is the same as that of the Oklahoma Light & Power Company, which distributes electricity from the Byng plant in several cities and towns of southern Oklahoma, and that in order to fix rates for the latter company intelligently it is necessary to have possession of monthly reports of the Southern Oklahoma Power Company.

United States Navy Airplane Carriers to Have Electric Drive.—Two airplane carriers now under way for the United States Navy under plans altered from others originally drawn for battle cruisers which, under the limitation program, will not be built are to be electrically equipped throughout by the General Electric Company. Powerful turbo-generators will drive the propellers through huge electric motors, two for each of the four propeller shafts. Rear Admiral Griffin, former chief of the Bureau of Engineering, says that these boats will represent "the greatest horsepower per shaft that has ever been projected in any marine installation, irrespective of the type of motive power." The propulsion apparatus is the same, barring minor alterations, as was planned for the original battle cruisers. The generators will be operated by steam from sixteen oil-fired boilers and each will have a rating of 40,000 kva., 5,000 volts, three-phase, 1,770 r.p.m.

Associations and Societies

Rocky Mountain Electrical Co-operative League. — The second annual meeting of this association was held at Salt Lake City on Dec. 4, when the sixteen members of the board of trustees were chosen, four each from the central-station industry, the manufacturers, the jobbers and the contractor-dealers. W. A. Moser was made chairman of the league for the ensuing year, A. J. Calloway vice-chairman and R. M. Bleak secretary and treasurer.

Southwestern Electrical and Gas Association.—Announcement is made of change of name of the Southwestern Electrical and Gas Association to the Southwestern Public Service Association. There will be no change in the purposes or activities of the association, and the office will be as heretofore at 403-4 Slaughter Building, Dallas, Tex. The spring convention will be held at Fort Worth, Tex., May 15 to May 17. E. N. Willis is secretary.

American Society of Civil Engineers.—Engineering education and engineering research figure prominently in the program of the civil engineers' seventieth annual meeting, to be held in the Engineering Societies Building, New York City, on Wednesday, Thursday and Friday next, Jan. 17 to 19. On Wednesday afternoon there will be a joint session with the Society for the Promotion of Engineering Education, when Prof. Charles F. Scott of Yale, president of the latter society; Dean William G. Raymond of the College of Applied Sciences, Iowa State University; Magnus W. Alexander, consulting engineer, General Electric Company, and John L. Harrington, president A. S. M. E., will speak. Research activities will be discussed on Friday morning by prominent engineers.

Empire State Gas and Electric Association.—The electric meter section of this association will meet at the Onondaga Hotel, Syracuse, N. Y., on Monday and Tuesday, Jan. 22 and 23. On Monday "Demand-Meter Maintenance" will be discussed by E. A. Le Fever, Buffalo General Electric Company; "Electric Demand Rates" by W. M. Carpenter; "Metering Problems in Changing Distribution" by W. Davies, Public Service Corporation of New Jersey; "Instrument Transformers" by J. B. Gibbs, Westinghouse Electric & Manufacturing Company, and "Potentiometers" by I. Melville, Stein, Leeds & Northrup Company. On Tuesday C. L. Casler, Syracuse Lighting Company, will discuss "Maintaining Meters Under Public Service Commission Order"; F. C. Holtz, Sangamo Electric Manufacturing Company, "Measurement of Electric Energy and Power," and B. W. St. Clair, General Electric Company, "Jewels and Pivots."

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

National Council Lighting Fixture Manufacturers—Cleveland, Jan. 15-20. C. H. Hofrichter, 231 Gordon Square Bldg., Cleveland.

Lighting Fixture Dealers' Society of America—Cleveland, Jan. 15-20. J. L. Wolf, Electrical League, Hotel Statler, Cleveland.

Western Association of Electrical Inspectors—Chicago, Jan. 23-25. W. S. Boyd, 175 W. Jackson Blvd., Chicago.

Iowa Engineering Society — Des Moines, Jan. 23-26.

Wisconsin State Association of Electragists—Milwaukee, Jan. 24-26. H. M. Northrup, 23 Erie St., Milwaukee.

Association Municipal Electrical Utilities of Ontario—Toronto, Jan. 25-26. S. R. A. Clement, 190 University Ave., Toronto.

Electrical Supply Jobbers' Association—Central Division, Chicago, Feb. 13-14; Atlantic Division, New York, Feb. 14; executive committee, Atlantic City, Feb. 15-16. Franklin Overbagh, 411 S. Clinton St., Chicago.

American Institute of Electrical Engineers—New York, Feb. 14-16. F. L. Hutchinson, 33 West 39th St., New York.

American Institute of Mining and Metallurgical Engineers — New York, Feb. 19-21.

American Physical Society—New York, Feb. 24; Washington, April 21. D. C. Miller, Case School of Applied Science, Cleveland.

Oklahoma Utilities Association—Oklahoma City, March 12-14. O. D. Hall, 1106 First National Bank Bldg., Oklahoma City.

Southwestern Division, N. E. L. A.—Oklahoma City, March 14-16. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Illinois State Electric Association—Chicago, March 16-17. R. V. Prather, 305 Mine Workers' Bldg., Springfield, Ill.

Wisconsin Utilities Association—Milwaukee, March 22-23. John N. Cadby, 445 Washington Bldg., Madison.

American Electrochemical Society — New York, May 3-5. Colin G. Fink, Columbia University, New York.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

Recent Court Decisions

Nebraska Commission Sustained.—Affirming a decision of the Nebraska Railway Commission in Rawlings vs. Chicago, Burlington & Quincy Railroad Company, the Supreme Court of Nebraska declared that on any appeal from a commission order the finding of the commission would receive the same weight as the verdict of a jury and would not be reversed unless clearly wrong. (190 N. W. 569.)*

Six Thousand Dollars for Death of Electric Helper Not Excessive.—The Supreme Court of Appeals of West Virginia, in Halley vs. Ohio Valley Electric Railway Company, has declared not excessive a verdict for $6,000 for the death of an electric helper from injuries received while installing a transformer in an electric substation. He was put to work on a ladder which stood only a few inches from an exposed and energized bushing, the dangerous character of which was unknown to the youth, who was inexperienced. (114 S. E. 572.)

United States May Maintain Storage Pond at Maximum Height for Power Purposes.—Suits brought by Phillips et al. against Waters et al. and Wheeler et al., and in which the Sterling Hydraulic Company and the Rock River Light & Power Company sought to intervene as defendants, asked for an injunction against the agent of the United States having charge of a federal dam in the Rock River to compel him to open the sluicegates in the winter months, thus stopping the operation of the power plant to which the government's hydraulic system was leased. A decree granted by the lower court has been reversed by the United States Circuit Court in Illinois, which holds as follows: (1) When the United States in lawful exercise of its authority builds a dam for purposes of navigation, the water power thus developed may be lawfully used by it or leased to any concern engaged in the development and distribution of power or electrical energy. (2) Where the United States government acquires the right to erect a dam to a certain height for the purpose of improving navigation, it also acquires as an incident thereto the right to use the pond for power purposes. (3) Injunction is not a proper remedy when the damage caused by the thing sought to be enjoined is relatively very slight compared with that which would be caused by its issuance. (4) Where the United States at large expense built a dam in aid of navigation and for seven years maintained it at a certain height without objection from owners of the land which was overflowed, and in the meantime a power company had built a plant at large cost to use the water from the pond made, such landowners are not entitled to an injunction which would stop operation of the power plant, but will be held to their remedy at law, especially in absence of showing that they would suffer substantial injury. (5) Condemnation decrees giving the United States the right to maintain a dam in aid of navigation at a stated height, on which basis landowners were compensated for flowage, entitles the government in its discretion to maintain the dam at such height during all times of the year. (284 Fed. 237.)

Electric Truck Not Attractive Nuisance.—An electric delivery truck by which a child was injured after he and other children had started it going was held not to have been an attractive nuisance by the Supreme Court of Michigan, in Jackson vs. Mills-Fox Baking Company. In this case the driver of the truck shut off the power and set the brakes while he carried purchases to a private house, but did not remove the switch plug. The court, reversing the lower tribunal, found no negligence and said that the starting of the car by the trespassing children was the proximate cause of the accident. (190 N. W. 740.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Capitalizing Non-Utility Property.—A public utility may capitalize all the property it owns although it may not include property not devoted to public service in its rate base, according to a decision of the New Hampshire Public Service Commission *in re* Exeter & Hampton Electric Company. The commission therefore included in a valuation for the purpose of issuing securities an office building a part of which was rented for other than utility purposes, stating that rates and capitalization rested upon different bases.

Capitalization of Savings.—The annual savings of the Kootenai Power Company under a favorable contract were capitalized at the rate of 8 per cent, and half of this amount was added to the rate base by the Idaho Public Utilities Commission. The question, the commission said, was "whether or not the Kootenai Power Company is entitled to receive any of the benefits which may accrue by reason of its diligence in taking advantages of opportunities which make for economy in the furnishing of electrical energy to its consumers. This utility is one which is and has been managed efficiently and economically. . . . A public utility should be encouraged to practice economy in its management, and the utility that practices economy should not be placed on a par with the utility which is extravagant in its operation. A utility should not have the full benefit accruing by reason of such arrangements, but it is entitled to a portion thereof. . . . In case the present conditions change from any cause whatever, the amount herein allowed shall be deducted from the valuation hereinafter determined."

Rural Service Charges.—In authorizing the Leopolis Electric Light & Power Company to make adequate charges to meet the additional expense from excessive transformer losses in supplying rural consumers the Wisconsin Railroad Commission said: "Data furnished by the company indicate that over one-half of the energy purchased is dissipated before reaching the customer. In order that those consumers who cause the unusual expenditures shall contribute more materially to the revenues, the commission has in nearly all cases involving rural rates authorized a line or transformer charge in addition to the regular rates. This charge is dependent partly on the size of the transformer required by the customer. In this particular case we believe that a transformer charge is necessary for all consumers not located in groups having the saturation density of villages."

Revenue Derived from Other States May Be Considered in Fixing Rates.—Although a state commission has no jurisdiction over rates in a neighboring state, it may, according to a decision of the North Dakota Board of Railroad Commissioners in fixing rates for the Pembina Light & Power Company, take into consideration the total revenues and expenses of the utility and the amount of the utility's product sold in towns out of the state. The commission said it would expect the utility to look to other towns than the one in question for a portion of the increased revenue necessary to meet operating expenses, depreciation and return. The commission added: "If the utility, in view of the facts disclosed by this investigation, desires to furnish electricity to towns outside our jurisdiction at cost or less, it cannot expect to make up losses by excessive rates elsewhere."

Adjusting Expense of Inductive Coordination.—The Public Service Commission of Missouri has ordered the Clifton Hill Light & Power Company, which, it was alleged, had made the service of a telephone company of no effect on the two possible routes between two towns, to stand the first cost of one additional telephone wire so as to provide a metallic circuit, and it was required to build its stub lines according to standard specifications, and where the stub lines overbuilt or paralleled in close proximity the rural grounded lines of the telephone company the electric company was required to stand the expense of separating the grounded telephone lines from the transmission line for a distance equal to the width of the country roads in that territory. In view of the fact that better telephone service would be obtained by the metallicized lines, the telephone company was required to pay for the maintenance, depreciation and pole rental of the lines.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

Worth Bates, treasurer of the Missouri Gas & Electric Service Company, has been appointed a member of the city advisory committee of Lexington, Mo.

Francis C. Shenehon has been appointed vice-president and general manager of construction and engineering of the Byllesby Engineering & Management Corporation, with headquarters at Chicago.

Major-General George W. Goethals was appointed State Fuel Administrator on Tuesday, Jan. 9, by Governor Smith, to succeed William H. Woodin, who resigned because of the pressure of private business.

Charles H. Brown assumed the duties of superintendent of the North Birmingham (Ala.) light and water plant last week, succeeding Henry S. Hill, who tendered his resignation about a month ago to become chief clerk in the office of Sheriff T. J. Shirley.

Douglas Betts, chief engineer of Messrs. Debenhams, Ltd., electrical engineers of London, England, recently visited the Pacific Coast. Mr. Betts, who is a member of the American Institute of Electrical Engineers, is touring the United States for the purpose of investigating recent hydro-electric developments.

John J. Hubbard, assistant secretary of the Public Service Commission of New York, resigned last month to enter private practice as an expert accountant and financial adviser to public utilities. He will maintain an office in New York City. Mr. Hubbard has been connected with the Public Service Commission for ten years in various positions, including examiner of accounts, expert accountant and chief of the division of capitalization.

Edward J. Nally, who was elected to the new office of managing director of international relations of the Radio Corporation of America, as was announced in the Nov. 25 issue of the ELECTRICAL WORLD, assumed his duties on Jan. 1, when he was succeeded in the presidency of the corporation by Major-General James G. Harbord, who retired from the army.

August H. Meyer has been elected president of the Langstadt-Meyer Company, Appleton, Wis., replacing A. C. Langstadt, who is no longer connected with the organization. R. S. Saxton, formerly manager of the Milwaukee branch of the Westinghouse Lamp Company, will be associated with the company as vice-president and sales manager, and J. G. Harvey, formerly sales manager of the Luxam Electric Company, Fort Wayne, Ind., will be manager of the company's Oshkosh (Wis.) branch.

W. A. Moser Elected Chairman of Rocky Mountain League

Walter A. Moser, manager of the Westinghouse Electric & Manufacturing Company at Salt Lake City, was elected chairman of the Rocky Mountain Electrical Co-operative League at the second annual meeting of the league, held in December. Mr. Moser completed two years' apprenticeship with the Westinghouse company at East Pittsburgh, Pa., in 1911. He entered the sales department of the Salt Lake City office of that company in August, 1911, and was made manager in 1920, which position he now holds. Mr. Moser was born in Union Hill, N. J., in 1886 and was graduated from the University of Nebraska with the degree of bachelor of science in electrical engineering in 1907.

W. A. MOSER

Verne L. Havens, director of the *Ingeniería Internacional*, has been made permanent secretary of the International Engineering Congress, composed of engineers of North America and the Latin-American republics.

John M. C. Horn, who was comptroller of the Illinois Traction System, Peoria, Ill., with headquarters at Champaign, Ill., resigned that position on Jan. 1. Mr. Horn had been with the Illinois Traction System and its component companies for fourteen years, having served in the general offices at Champaign during that time. He has made no plans for the immediate future. The position vacated by Mr. Horn will be filled by T. A. Smith, supervisor of capital expenditures for the same company, who for the present will conduct the work of both offices.

F. S. Mills has been appointed representative of the Illuminating Engineering Society in Los Angeles. Mr. Mills has recently been made director of the activities of the National X-Ray Reflector Company in the territory from Denver west, including the Hawaiian Islands.

W. C. Chappell, noted English hydro-electric engineer, recently visited San Francisco en route from Australia. Mr. Chappell is known in Australasia as the man who gave Tasmania its first electric lights and street cars. He supervised the construction of a 57,000-hp. hydro-electric plant near Hobart, Tasmania, and later, as chief electrical engineer of the State Electrical Commission of Victoria, was in charge of the erection of a steam plant at Melbourne.

Harry L. Brown, who was for some time Western editor of the *Electric Railway Journal* at Chicago and has more recently been managing editor at New York, has been appointed co-editor of the paper with Henry W. Blake. Mr. Brown joined the *Electric Railway Journal* staff at the Chicago office in 1916, having become connected with the McGraw-Hill Company a year before as assistant editor of the ELECTRICAL WORLD. He is a graduate of the University of Michigan and is well known in the railway field, particularly in the central territory.

J. E. Yorkston has recently been promoted from the position of engineer in charge of the drafting department of the General Electric Company to that of consulting mechanical engineer. In his new capacity Mr. Yorkston will assist the designing engineers of the company in connection with important mechanical problems and will also serve as a consulting authority in all matters pertaining to drafting practice. He was first employed by the General Electric Company in 1894 as a designing draftsman. Three months later he was put in charge of the alternating-current drafting department, and in 1902 he was made assistant engineer of the works drafting department. In 1907 he was again promoted to be engineer in charge of drafting, which position he held continuously until his present promotion. He is also chairman of the committee on drafting practice and a member of the committee on mechanical design.

Obituary

Mabel Hubbard Bell, widow of Alexander Graham Bell, inventor of the telephone, died on Tuesday evening, Jan. 2, in Chevy Chase, Md., at the home of her daughter. Mrs. Bell never recovered fully from the shock of her husband's death last summer. Mrs. Bell lived under an affliction of total deafness that followed a severe attack of scarlet fever in her childhood. It is said that Dr. Bell's hope that he might find a means of enabling her to hear led to experiments in the realm of phonetics which resulted in his great discovery.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Waste in Advertising

The Bad Influence of "Free Literature"—The Dealer Should Share in the Cost to Make Him Careful—Manufacturer and Seller Should Unite for Efficient Publicity

BY J. C. MCQUISTON
Manager Department of Publicity,
Westinghouse Electric & Manufacturing Company

NO ONE can deny that there is waste—much waste, large waste—in advertising. Somehow we have come to accept it as a condition, much like that of waste in fuel. Take a ton of coal and burn it in your furnace. Will you get all of the heat units out of it? Even if your furnace is the most efficient you know, you will lose far more than you will get. That is why the battle is ever on for more efficient grates and burners, boilers, etc. And so it is in advertising. Our fight to reduce waste in advertising must be courageously continued.

Let us consider the advertising that we ourselves control—our direct mail and our literature for consumers. Do we know what our waste is? No doubt all of us sleep better because we do not know the facts in the case. Enough is known, however, about this waste to stir every user of direct advertising to eliminate much of it.

J. C. MC QUISTON

"FREE LITERATURE" AN EVIL

One of the causes of flagrant waste is "free literature." This is a disease in advertising. It is cancerous, because it draws the very lifeblood from this kind of advertising. We all know how much a "free" thing is appreciated. Make a concert free and you prepare the way for either an empty house or a "cheap crowd." The manufacturer who gives without charge all advertising "helps," including folders, "trims," cards and so on, will get rid of large quantities. That is just what he will do, but no more—he will "get rid of them." But, of course, he intended to do more; he expected the "helps" to be mailed to prospective customers. He desired every copy to find a lodgment in the home or business of such a person. But the "life" of the scheme was lost when the plan was cheapened by being "free." The dealer thought he was interested, and you, the manufacturer, thought the dealer was interested, but the facts are that the interest was only on the surface.

When the manufacturer offers the dealer all of some three-color folders he wants, and the dealer says, "Better let me have two thousand," does the dealer say to himself, "I can make good use of two thousand by addressing eighteen hundred from my up-to-date mailing list and two hundred can be used on my counter. I will use them very carefully because two thousand copies of this beautiful folder must be worth $200." On the contrary, you know he knows little, and cares less as a rule, what they cost. Any manufacturer who does not know this to be so can find out by following up some of those free and easy requisitions that come in from his dealers. He might even visit some of those dealers and ask where their last folders went. Is it not his duty to inquire into this?

Printed sales helps represent so much money. When you send them to your dealer you are sending just so much cash, for you have paid cash for writing, planning, printing and shipping them to the dealer. The dealer should be made to appreciate this, so that when he sees a pile of printed folders in his stockroom, out of date, dust-covered and obsolete, he will realize that it represents waste—waste in advertising, which represents waste of real American money.

DEALER SHOULD SHARE COSTS

I recall returning from an advertising conference at Bedford Springs, Pa., where waste in advertising had been made one of the chief topics. Our party of five were motoring along the Lincoln Highway at Stoyestown, when immediately in front of a garage at this place a tire blew out. While repairs were under way the party, strolling about the garage, beheld stacks of automobile and accessory folders which had, conservatively speaking, a value of $1,000. Think of it! How many manufacturers in good faith had sent this man supplies of literature, and here it was ready to be burned. I would regard it as a safe guess that one-half of the auto literature given to the dealer "free" is wasted.

For economical and other reasons it would not be practical for the dealer to prepare and print his selling "helps." In many ways, if he could do it, however, the work would be better done. For if the dealer *did* do it, you could rely on his knowing the cost and realizing the value of it, and he would therefore, with certainty, see to it that such matter was properly used—not wasted.

Even as things are, with manufacturers for the most part printing and paying for the dealer helps, the dealer would be in a more sound position if he paid a portion—say one-half of the cost of all dealer helps requisitioned by him. If he realized in every case that when he asks his manufacturer for helps he is obli-

gating himself to pay some of the cost of producing such helps, he would be prompted to consider ways and means of using the literature. His demands would be tempered by consideration of investment, and thus this costly waste would be greatly reduced.

Free literature, advertising "helps," etc., are conducive to careless practices and waste. The sooner this problem of the efficient promotion of advertising as between the one who makes and the one who sells is brought to a point where the cost is shared by both, the sooner will millions of dollars be saved to many industries, to say nothing of greater effectiveness resulting from such joint efforts.

Our Largest Potential Foreign Customer

Importance of Great Britain as a Market and as a Source of Education in Foreign Trade—Some of the Difficulties Encountered in Promoting Business with Her

By Caxton Brown
Secretary Weston Electrical Instrument Company, Newark, N. J.

A RATHER careful reading of numerous articles dealing with foreign trade opportunities that have appeared recently reveals the fact that it is very seldom that writers give any attention to our potential market in the British Isles. Yet Great Britain is this country's largest foreign customer.

I do not minimize the trade possibilities that exist in the Latin-American countries, the Far East or other export markets. They are all worthy of close attention, but sometimes it seems to me that there is more theory and less common sense applied to the development of foreign markets than should be the case.

Offers Favorable Conditions

Great Britain has shown the most powerful recuperative possibilities of all markets. It is an English-speaking country. Its methods of doing business are most similar to our own, and, generally speaking, its electrical products do not equal our own either in design or workmanship. Surely these are conditions that warrant a careful study of the best method of securing a fair share of that market. For were we considering the matter from a domestic viewpoint, I believe that any intelligent manufacturer would lay most stress on an effort to secure the good will and trade of his largest potential customer.

All foreign trade is beset with difficulties at the present time. There are troubles of exchange and finance and tariff difficulties which are largely reciprocal; there are passport visas with ridiculous fees, also of a reciprocal nature, and depression in business, all to combat. But these obstacles will not endure forever, and those who endeavor to overcome them in a sane manner can establish connections that will yield attractive returns later on. It is worth consideration that it is easier to obtain a firm foothold now than it will be later on when business is better and more American companies make the effort.

But the intending American exporter should by all means go after this market in an earnest, determined manner and be ready to back his opinions. Haphazard efforts will produce no satisfactory results. His first step should be to analyze all available data, including our own consular reports and British statistics, upon the amount of imports of his particular article. He should secure catalogs of all British competitors and, if feasible, samples of their product. With such information available it will be possible to establish laid-down costs in England for his own product, and should these costs be higher than the price of British-made articles, he may determine whether the price disadvantage may be offset by superior quality or superior serviceability. If neither of these latter advantages exist, the market had better be left alone.

However, should it be deemed possible to export advantageously, then the best procedure would be to make a trip to England to obtain exact information as to the preferable methods of sale—whether through dealers, jobbers or through an exclusive agency. Likewise, careful study should be made of the volume or extent of the sale of the British-made articles which are offered in competition and of the best advertising mediums.

The American Chamber of Commerce in London and our own consular force and commercial attachés will cheerfully assist in such research work and indeed will, I am sure, be glad to furnish much valuable information by mail.

It is difficult for me to try to say specifically just which type of electrical products at this time will be apt to find the greatest opportunity in the British market. I have not investigated or studied the problem from this point of view, our attention being pretty fully occupied with our own line and the affairs of our own British company. In general, I may say that I do not believe that lamps or large motors or generators could profitably be exploited in England; but were I manufacturing any other electrical contrivances or devices and were I interested in exporting them, I would at once start my research work in this market as previously indicated.

Tariff Difficulties

Of course, the prospective importer to the British Isles must not overlook the fact that Great Britain is no longer a strictly free-trade country, for within the past two years laws have been passed which impose an import duty of 33⅓ per cent on many articles and commodities. However, we in this country are hardly in a position to throw stones on that score, because it is a well-known fact that many of the tariffs encountered in conducting foreign trade are to a great extent of a retaliatory nature. Indeed, one of the greatest impediments to world trade today is the vicious circle of retaliatory tariff barriers.

Notwithstanding that it is largely in our own power to reduce these barriers, we seem to make very little, if any, progress in that direction, and by many our latest tariff law is believed to increase these difficulties rather than diminish them. So that if one is inclined to demur at Britain's change from a free-trade to an import-tariff country, he should first study the question from all angles.

Another obstacle that appears somewhat insignificant at first glance and yet which has its importance for United States companies employing foreign travelers is the ridiculous charge made for visas of passports. Visa charges were quite moderate until the United States decided to charge citizens of other countries a ten-dollar fee for a passport visa. It naturally required very little time for other nations to reciprocate in kind, and now the citizen of the United States pays a ten-dollar

equivalent every time he obtains a visa to visit another country, while a citizen of any other country pays only a moderate sum for the same kind of visa. This visa expense is not at all insignificant when viewed in the light of a commercial traveler from the United States, as many American companies will cheerfully testify, and the matter is referred to merely to indicate that import duties and visas should not be neglected as factors to be considered.

Dr. Julius Klein, chief of the Bureau of Foreign and Domestic Commerce of the United States, recently said in an address: "We must be familiar with the situation in Great Britain for two reasons, that we may be able to appraise possible foreign competition and that we may be able to appraise foreign buying power. England has long been and will for years probably continue to be our best foreign customer and our best rival in foreign trade. She can also be our best teacher, and we need education and need it badly."

Great Britain should, therefore, not be disregarded as a market by the American manufacturer who wishes to sell his goods abroad. Yet it must be expected that real success can be accomplished only by building slowly, sanely and surely. That sort of business endures, whereas it is true of export business as of money that that which is easily obtained is easily lost.

Finally, it should be understood by those intending to enter into the exporting field for the first time that European business has been at its lowest ebb for approximately two years. There are now quite distinct signs of improvement, yet one must be a prophet of extraordinary foresight to attempt to forecast how soon and how rapidly business will approach normal. That matter is largely in the hands of the politicians and bankers, and they have yet to solve many problems essential to permanent business stability.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

Battery Stocks Spotty in New England

Stocks of dry cells in New England reflect uneven delivery conditions as the year gets under way. Prices are holding firm, and the demand is active for radio uses as the public becomes better informed about the possibilities of operating certain tube sets with this sort of equipment. Fairly good buying of dry cells is reported by jobbers on the part of contractor-dealers, and flash-lamp business is always reasonably active at this season.

A healthy absorption of such batteries into new residences for bell-ringing service is also in progress. In the storage-battery field some sales are being made for automobile service, notwithstanding the heavy winter weather and great reduction in car usage. Stocks are none too large, but are meeting current requirements well. Prices are firm. The outlook for better battery sales for industrial and road truck service in this territory this year is excellent.

Heater Sales Quieter

The demand for radiant heaters since the holidays has shown a considerable recession, and unless scarcity of coal for domestic use makes itself felt more seriously, it is not expected that any immediate marked increase in sales will be recorded. Stocks in the hands of distributors and retailers were substantially lowered before Cristmas, but buying since 1923 began has been on a hand-to-mouth scale. While prices are firm, difficulties in obtaining steel are a factor in production which is causing no little consideration, and anticipation of requirements has to be very carefully planned in order to insure an even flow of sheets for cutting and assembly.

Factory stocks are of moderate size, and these are relied upon by a good many distributors within fairly easy reach of the manufacturers to meet current demands outside of local stock facilities. It is the opinion in some circles that intensive sales effort combined with fair local stocks would improve trade materially in this apparatus, which in many communities has almost reached the staple class in the public mind.

Raw-Material Advances Push Tape Prices Upward

Recent advances in the cost of rubber and sheeting, amounting to about 100 per cent since the last schedule of a representative manufacturer went into effect, have forced the price of tape upward lately, and the outlook seems to be for a so-called "high market" for the coming half year. This advance in tape was not unexpected in the trade, but in many quarters the disposition to look upon it as a temporary condition resulted in the placing of relatively few orders by distributors.

The moderate supply on hand has led to a flood of orders upon manufacturers, and in some instances production is under way for full-time days and also for part of the nights. So far there seems to be little shortage of labor in this branch of the industry. Manufacturers are buying material on a short-term basis in view of the price situation, which has some uncertainties that well-informed opinion heeds in refusing to make large commitments.

Generator Figures in Error

The 1922 production figures for generators, both waterwheel and turbo, were: Waterwheel, 1,200,000 kw., and turbo, 1,575,000. These figures erroneously appeared in the ELECTRICAL WORLD for Jan. 6, page 70, as 200,000 kw. for waterwheel, 575,000 kw. for turbo.

Estimates 1923 Construction at $6,000,000,000

Based upon a survey which it has just completed, the Copper and Brass Research Association estimates the total building construction for the year 1923 at $6,000,000,000. The potential market for copper in building construction in this country next year (including sheet copper for roofing, leaders and gutters, etc., as well as the copper content of the brass used in plumbing pipe, hardware and lighting fixtures) is approximately 780,000,000 lb.

In 1922, statistics for eleven months of which are now available, the total expenditure for building construction is placed at $4,910,000,000. In addition, there were projected, but not built, other buildings of a total estimated cost of $2,480,000,000.

In estimating the amount of building construction in 1923, the carry-over from 1922 has been reduced to $1,240,000,000, because experience indicates that in making preliminary estimates the cost is usually placed on the safe side, and allowance is also necessary for the percentage of such projects that has been indefinitely postponed or will not come up in 1923.

Taking the known accumulated shortage as a basis, after deducting work completed during 1922, and adding the normal increment of building for the year 1923, the actual building requirements of the nation are estimated at $7,830,000,000. Details of the 1923 estimates and the expenditures for the same classes in 1922, follow:

	1923 Estimates	1922 Expenditures
Apartment houses	$1,253,000,000	$950,000,000
Churches	530,000,000	205,000,000
Dwellings	940,000,000	680,000,000
Hospitals	595,000,000	230,000,000
Hotels	851,000,000	640,000,000
Industrial buildings	827,000,000	655,000,000
Office buildings	804,000,000	645,000,000
Public buildings	328,000,000	260,000,000
Public garages	162,000,000	125,000,000
Schools	1,540,000,000	610,000,000
Total	$7,830,000,000	$5,000,000,000

To predict such a vast amount of building during the year 1923 presupposes that the entire shortage plus the normal increment for the year will be carried out in 1923 and that we shall enter 1924 with a clean building slate. It is believed by the association, however, that neither the financial nor the material and labor resources of the country are in a position to carry out this program in twelve months.

The association's reports indicate that there still exists over the major part of the country a housing shortage of considerable proportions, despite the huge construction of 1922.

There are, of course, no definite data to go on in estimating how far the present resources of the country and the labor and materials situation will enable it to go in the 1923 building program, but careful consideration of the various factors involved leads to the estimate of $6,000,000,000 as the amount which can be completed in 1923.

Of this amount about $3,030,000,000 will be devoted to housing, about $2,025,000,000 to office, business and industrial buildings, and $2,675,000,000 to churches, hospitals and schools.

ENGLISH ELECTRICAL EXPORTS, IMPORTS AND RE-EXPORTS FOR NOVEMBER, 1922

	Export	Imports	Re-exports
Electrical goods and apparatus	£123,273	£52,794	£2,612
Insulated wires and cables	179,447	17,182	.....
Glow lamps	28,235	28,690	416
Arc lamps and parts	1,320	1,255	.....
Batteries and accumulators	32,950	17,799	2,070
Meters and instruments	32,937	6,337	107
Carbons	2,967	7,030	205
Electrical Machinery:			
Railway and tramway motors	14,593	.....	.....
Other motors and generators	144,232	.....	.....
Switchboards (not telegraph or telephone)	10,690	4	.....
Electrical machinery, unenumerated	137,596	72,539	6,183
Telegraph and telephone cable and material:			
Telegraph and telephone wires and cable (not submarine)	27,325	4,673	.....
Submarine telegraph and telephone cable	51,255	.....	.....
Telegraph and telephone instruments and apparatus	157,254	41,879	762
Totals	£944,074	£250,182	£12,355

November Electrical Exports Show Gain of $939,646

Total exports of electrical machinery, apparatus and appurtenances for the month of November were $5,817,349, a gain of $939,646 over November, 1921, when the total amounted to $4,877,703, and of $693,878 over October, 1922, when they were $5,123,471. The following figures are supplied by the Bureau of Foreign and Domestic Commerce:

ELECTRICAL EXPORTS FOR NOVEMBER, 1922, COMPARED WITH CORRESPONDING PERIOD A YEAR AGO

Articles	Value November, 1921	Value November, 1922
Turbines	.....	$245,596
Generators	$437,057	.....
Direct-current—		
Under 500 kw.	.....	41,633
Over 500 kw.	.....	6,096
Alternating-current—		
Under 2,000 kw.	.....	100,161
Over 2,000 kw.	.....	288,323
Accessories and parts for generators	.....	35,077
Self-contained lighting outfits	.....	31,293
Batteries	175,674	.....
Primary—		
Dry	.....	83,267
Wet	.....	4,982
Storage	.....	149,114
Transforming and converting apparatus:		
Transformers	285,581	.....
Power	.....	315,121
Other	.....	32,482
Rectifiers	.....	5,764
Condensers, double-current and motor generators, dynamotors, synchronous and other converters	.....	37,150
Transmission and distribution apparatus:		
Switches and accessories	81,193	.....
Switches and panelboards, except telephones	.....	323,788
Switches and circuit breakers	.....	97,553
Fuses and fuse plugs	.....	29,525
Meters and measuring instruments	$95,254	.....
Watt-hour and other measuring instruments	.....	31,324
Volt, watt and ampere meters and other recording, indicating and testing apparatus	.....	68,019
Lightning arresters, choke coils, reactors and other protective devices	.....	43,366
Motors, starters and controllers:		
Motors under 1 hp.	.....	66,831
Stationary motors—		
1 to 200 hp.	.....	120,181
Over 200 hp.	.....	48,156
Railway motors	.....	134,940
Electric locomotives	376,990	.....
Railway	.....	548,000
Mining and industrial	.....	12,109
Other motors	495,966	14,887
Rheostats, controllers and other starting and controlling equipment	46,381	76,611
Accessories and parts of motors	.....	85,147
Electrical appliances:		
Electric fans	$43,479	$34,441
Electric lamps:		
Arc	2,070	2,402
Incandescent—		
Carbon filament	2,599	5,942
Metal filament	83,046	96,047
Other electric lamps	.....	22,206
Flashlights	.....	19,815
Searchlights and projectors	.....	19,521
Motor-driven household devices	.....	78,756
Domestic heating and cooking apparatus	70,155	73,860
Industrial electric furnaces and ovens	.....	6,894
Therapeutic apparatus, x-ray machines, galvanic and faradic batteries	.....	64,917
Signal and communication devices:		
Radio and wireless apparatus	.....	223,180
Telegraph apparatus	20,660	34,615
Telephone apparatus, including switchboards	242,603	318,336
Police, fire and burglar alarm apparatus	.....	1,665
Railway signals, switches and appurtenances	.....	129,212
Bells, buzzers and annunciators	.....	5,014
Other electrical apparatus:		
Spark plugs, magnetos and other ignition apparatus	70,384	58,388
Insulating material	.....	65,149
Metal conduit, outlet and switch boxes	.....	18,125
Sockets, outlets and receptacles	.....	56,138
Other wiring devices	85,624	127,926
Other electrical apparatus, not elsewhere specified	1,599,629	478,337
Globes and shades for lighting fixtures	.....	41,065
Electrical glassware, except for lighting	.....	7,828
Electrical porcelain	.....	47,346
Carbons for electric lighting, electrodes and batteries	30,607	163,385
Insulated wire and cables (iron and steel)	.....	44,750
Other manufactures of aluminum, including wire	154,672	52,799
Copper:		
Bare wire	66,690	265,159
Insulated wire and cable	411,389	177,625
Total electrical machinery, apparatus and appurtenances	$4,877,703	$5,817,349

English Exports and Imports for November, 1922

The British Board of Trade records of electrical business for the month of November show a decrease in values of £64,207 on last month's totals and £296,736 as compared with November last year. The figures for the month were £944,074; for October, £1,008,281 and for November, 1921, £1,240,810. The principal decreases occurred in the items for batteries, £36,000, and telegraph and telephone exports, £22,000; lower values were also recorded in the sections for electrical goods and apparatus, lamps, carbons and electrical machinery, while slightly increased values are shown in the items for insulated wires and cables and meters. Electrical imports at £250,182 for the month under review show an increase of £30,000 on the total for October, 1922, and £70,000 as compared with November, 1921. An addition of £28,000 in the electrical machinery import section accounts for the enhanced values for the month. The electrical re-export figures for November were £12,355, an increase of £1,300 in October, but a decrease of £2,400 in November, 1921.

The Metal Market

Copper Sales Not Heavy—Foreign Demand Quiet—Lead at 7.25—Zinc Active

Copper sales have not been heavy during the last week, but producers are not concerned, for they did such an excellent business in December that they are well sold up and expect a quiet January. Foreign demand is quiet, with a resumption of Chinese buying an encouraging feature.

A slightly increased activity is noticeable in zinc, but prices show only a small change.

NEW YORK METAL MARKET PRICES

Copper	Jan. 3, 1923 Cents per Pound	Jan. 10, 1923 Cents per Pound
Electrolytic	14.75-14.87½	14.75
Lead, Am. S. & R. price	7.25	7.25
Antimony	6.35	6.35
Nickel, ingot	36.00	36.00
Zinc, spot	7.05	7.05
Tin Straits	38.87½	38.87½
Aluminum, 98 to 99 per cent.	23.00	23.00

Brisk High-Tension Equipment Business in Chicago

Chicago manufacturers of high-tension equipment are unanimous in stating that their business volume in 1922 was above that obtained in 1921. One firm during the week sold three 44,000-volt outdoor substations with capacities of 300 kw. to 900 kw. to a Middle Western utility and six 13,000-volt substations of from 75 kva. to 300 kva. for other Middle West concerns.

Another firm reports that the money value of its 1922 business was 56 per cent greater than that in 1921. This concern received an order during the week for a 33,000-volt, 1,000-kva. substation for a Minnesota utility and shipped a 110,000-volt air-break switch to a utility in Georgia.

Foreign shipments of 25,000-volt fuses were made by another organization.

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

LOWER stocks are reported in most of the market centers of the United States, and the price trend in all parts of the country is upward. In the West there is slightly increased activity in porcelain and hardware for central stations, following recent storms and heavy snows which have seriously damaged some lines. Materials entering into new construction are selling as well as they did in the autumn months, and increased demand by the textile and metal-working industries is noted.

New York.—Business is settling down to a more normal stride, and sales show healthy conditions throughout the industry. Orders for lamps are coming in at an unusual rate, and the outlook for the next three months is most optimistic for this line. Stocks generally are low and prices have an upward tendency.

Chicago.—The aftermath of the holiday trade in heaters was rather slow because few jobbers had any stocks worthy of notice left over from the rush of the preceding two weeks. But by combing the local market a sufficient number of heaters were found to supply the past week's trade. Prices

Demand, Supply and Price Trend of Eighteen Commodities as Sold in Fourteen Cities

Explanation:
Demand: Steady, Slow or Active
Supply: Normal, Low or High
Price Trend: Firm, Decreasing or Increasing

Next Week
Reports will include
Flatirons, Rectifiers and
Instruments

	Wire	Armored Cable	Conduit	Transformers	Poles	Pole Line Hardware	Porcelain	High Tension Equipment	Fuses	Meters	Switches	Wiring Devices	Lamps	Commercial Fixtures	Motors	Heaters	Tape	Batteries
New York																		
Demand	Act.	Sdy.	Sdy.	Slo.	Slo.	Slo.	Slo.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Act	Sdy.	Sdy.	Slo.	Sdy.	Sdy.
Supply	Nml.	Hi.	Low	Low	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Low	Nml.	Nml.
Price trend	Inc.	Frm.	Inc.	Frm.	Inc.	Inc.	Frm.	Frm.	Frm.	Frm.	Frm.	Inc.	Frm	Dec.	Frm.	Frm.	Frm.	Frm.
Chicago																		
Demand	Sdy.	Sdy.	Act.	Sdy	Sdy.	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Act.	Act.	Slo.	Sdy.	Act.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Hi.	Nml.	Nml.	Low	Nml.	Nml.
Price trend	Inc.	Inc.	Inc.	Frm.	Frm.	Inc.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.
Boston																		
Demand	Act.	Sdy.	Act.	Slo.	Slo.	Slo.	Slo.	Slo.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Slo.	Act.	Sdy.
Supply	Nml.	Nml.	Nml.	Nml.	Low	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Low	Low	Low
Price trend	Inc.	Inc.	Frm.	Frm.	Inc.	Inc.	Frm.	Frm.	Frm.	Frm.	Frm.	Inc.	Frm.	Dec.	Frm.	Frm.	Inc.	Frm.
Atlanta																		
Demand	Act.	Slo.	Act.	Sdy.	Slo.	Act.	Slo.	Slo.	Act.	Slo.	Act.	Act.	Act.	Act.	Slo.	Act.	Act.	Sdy.
Supply	Low	Low	Low	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.
Cleveland																		
Demand	Act.	Sdy.	Act.	Act.	Act.	Act.	Slo.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Act.	Sdy.	Sdy.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Hi.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Frm.	Inc.	Inc.	Frm.	Frm.	Dec.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.
St. Louis																		
Demand	Sdy.	Sdy.	Sdy.	Sdy.	Slo.	Slo.	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Sdy.	Slo.	Sdy.	Inc.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.
New Orleans																		
Demand	Slo.	Sdy.	Act.	Act.	Act.	Act.	Slo.	Slo.	Sdy.	Sdy.	Act.	Act.	Act.	Act.	Act.	Slo.	Sdy.	Inc.
Supply	Low	Nml.	Low	Low	Low	Low	Low	Low	Nml.	Nml.	Hi.	Low	Nml.	Nml.	Low	Nml.	Nlm.	Nml.
Price trend	Inc.	Frm.	Inc.	Frm.	Inc.	Inc.	Inc.	Frm.	Frm.	Frm.	Frm.	Inc.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.
St. Paul-Minneapolis																		
Demand	Sdy.	Slo.	Sdy.	Sdy.	Slo.	Slo.	Slo.	Slo.	Sdy.	Act.	Slo.	Act.	Act.	Act.	Slo.	Sdy.	Act.	Sdy.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Frm.	Inc.	Frm.	Frm.	Inc.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.
Salt Lake City																		
Demand	Act.	Sdy.	Act.	Sdy.	Sdy.	Slo.	Act.	Sdy.	Slo.	Sdy.	Sdy.	Sdy.	Act.	Act.	Slo.	Sdy.	Sdy.	Sdy.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Low	Nml.	Hi.	Nml.	Nml.	Low	Hi.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Frm.	Inc.	Frm.	Inc.	Inc.	Inc.	Frm.	Frm.	Frm.	Frm.	Inc.	Frm.	Inc.	Frm.	Frm.	Frm.	Frm.
Denver																		
Demand	Act.	Act.	Act.	Slo.	Slo.	Slo.	Act.	Slo.	Sdy.	Slo.	Sdy.	Sdy.	Act.	Act.	Slo.	Slo.	Sdy.	Sdy.
Supply	Nml.	Nml.	Low	Low	Nml.	Nml.	Low	Low	Hi.	Nml.	Low	Nml.	Hi.	Hi.	Nml.	Low	Nml.	Low
Price trend	Inc.	Inc.	Inc.	Frm.	Frm.	Inc.	Frm.	Frm.	Frm.	Frm.	Frm.	Inc.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.
San Francisco																		
Demand	Act.	Sdy.	Act.	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Act.	Act.	Sdy.	Sdy.	Sdy.	Sdy.
Supply	Low	Nml.	Low	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Inc.	Frm.	Inc	Inc.	Frm.	Frm.	Frm.	Frm.	Inc.	Frm.
Portland-Seattle																		
Demand	Sdy.	Slo.	Act.	Act.	Act.	Sdy.	Slo.	Sdy.	Sdy.	Act.	Act.	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Low	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.
Price trend	Inc.	Frm.	Inc.	Frm.	Inc.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.	Inc.	Frm.	Frm.	Frm.	Frm.	Frm.	Frm.

remain firm and jobbers are rapidly replenishing their stocks according to their scheduled contracts.

Boston.—Business in New England reflects widespread confidence. Inventories were satisfactorily low on Jan. 1 in many electrical establishments, and buying has set in for current requirements. Lengthening deliveries are causing jobbers to stock up more than for some time. Prices trend upward, with advances in washing machines and tape and firmness in quotations for wire and steel products. The peak of the lamp business seems likely to be reached about Feb. 1, instead of the maximum having been scored in December as usual. Building operations are well sustained and the textile and metal-working industries are very active.

Atlanta.—This year has started off according to best expectations. Jobbers report satisfactory orders in all lines, although because of stock taking the majority of dealers have not had an opportunity to place their orders. These orders should be received within the next few days. The prosperity of the year just passed is reflected in the issuing of a 50 per cent stock dividend by the Carter Electric Company. This is in addition to a 12 per cent cash dividend. The cotton-oil industry has been held up by the shortage of cotton, and it has been necessary to close down several mills in this section. Bank clearings are in excess of any previous period, and the credit situation is easier than it has been for a great many months.

Cleveland.—Stocks are low, but completed inventories in some instances have allowed substantial orders. Batteries are in fair demand and tape is selling in fair volume. Dealers report heaters active, owing to the colder weather, but have been able to meet the demand without difficulty. Collections show improvement.

St. Louis.—Jobbers report business to be increasingly active to an unexpectedly large degree, one of the larger houses stating that January business will be fully 50 per cent better than that of a year ago. Another reported that December was the best month in its history. This condition exists in virtually all lines of goods handled, with the fundamental line of wiring supplies obtaining its share of the progress. The increased demand for radio equipment of the higher grades is producing good markets for batteries and for small battery chargers. The demand for automobile purposes is steadily increasing. The railroads and other regular purchasers of dry batteries are buying in normal quantities, and the sale of flashlight batteries is good. Stocks are conservatively maintained, with liberal turnovers, and business generally is sound.

St. Paul-Minneapolis.—Jobbers and dealers declare radio more active than before Christmas. Wire prices are stronger, but consumers are lying low. Power construction is dead. Tape demand is probably a little inclined to be active on account of activity in wiring. The heater trade is steady, compared with a very active market last fall.

Salt Lake City.—Central-station companies are buying well for extensions and new development, surplus stocks of copper being rapidly absorbed by the market, and production is steadily increasing. Collections are reported better than for months past. Jobbers are confident of steady improvement in electrical trade.

Denver.—Business during the first two weeks of the new year has been unusual. All jobbers report a good volume in excess of the similar period a year previous, while one has equaled the entire month of January last year. New business developing and the number of inquiries received support predictions that the year will be a good one. Collections in outside territory are slow, but few losses are being experienced. Heavy orders are being placed for pole-line hardware, transmission equipment and construction specialties in anticipation of new extensions and overhauling of country lines. One project alone in northern Colorado, not officially announced, will require considerable of this material and extensive generating equipment. High winds during the past week have played havoc with transmission lines and city distribution. Business in heaters has suffered.

Portland-Seattle.—Electrical jobbers report business active for the first week in January. There is an optimistic feeling regarding the prospects for the coming year. On the other hand, the retailers in the large cities report little activity on appliances and an appreciable slackness in the demand for fixtures. The falling off, however, does not seem to have been greater than the usual drop following the holidays. The Christmas trade this year was principally on lower-priced articles than formerly, which had the effect of lowering the gross volume of business.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Approves Wagner Refinancing

The Circuit Court has denied the recent application for a receiver made by a small minority of stockholders to prevent the transfer of assets of the Wagner Electric Manufacturing Company to the new company, Wagner Electric Corporation, and has simultaneously refused to cancel the transfer which has been made. The complete refinancing plan will consequently be carried out in the manner authorized by the stockholders. The operations of the company are now being conducted under the name of Wagner Electric Corporation.

General Insulate Sales Doubled

The General Insulate Company, 1008 Atlantic Avenue, Brooklyn, N. Y., manufacturer of electrical insulating specialties, reports that its volume of business during 1922 was more than 100 per cent over the year 1921. The year 1922 was the second largest year in volume of sales since the company was established nearly twenty years ago.

Milmow Opens Sales Office

Albert Milmow has opened an office in Charlotte, N. C., where he will conduct a business as a sales engineer in electrical and mechanical lines. At present he is handling the accounts of the Packard Electric Company and the Electrical Engineers' Equipment Company. He will also do some electrical consulting work.

Mr. Milmow is a pioneer in the electrical business in the South. He opened the sales office of the General Electric Company in Charlotte and was with the Southern Power Company as engineer of the mill-power department for some time, later joining the Westinghouse Company. He has been most active in the development of hydro-electric applications to industry.

Burdick Cabinet Expanding

The Burdick Cabinet Company, Milton, Wis., expects to occupy its new manufacturing plant, with 40,000 sq.ft. of floor space, about Feb. 1 and is now inquiring for additional equipment. Its principal product is a patented electrical bath cabinet and other therapeutic equipment and electric hospital appliances. It is increasing its capital stock by an issue of $100,000 preferred stock to cover the expansion.

Connecticut Electric Completes Warehouse

The Connecticut Electric Manufacturing Company, Bridgeport, Conn., has just completed the erection of a warehouse, 50 ft. x 140 ft., in which stocks of raw materials will be stored. This new building will allow a great deal of additional space in the main factory building for manufacturing operations. The amount of business booked by this company during the last few months has necessitated larger manufacturing operations than it has heretofore conducted, and every effort is being exerted to increase production to take care of this larger business.

Betts & Betts Announces Changes in Sales Organization

The Betts & Betts Corporation, 645 West Forty-third Street, New York City, manufacturer of refillable fuse plugs, bell-ringing transformers, radio apparatus and motor-driven controllers, announces the following changes in its sales organization: H. O. Klug has taken over the territory formerly covered by F. Maples, consisting of western Pennsylvania, Ohio, Michigan, eastern Indiana, northern Kentucky and West Virginia. Mr. Klug will probably make his headquarters in Cleveland. John Gilmore, formerly with the Barber Manufacturing Company, replaces J. E. Eldredge. His territory will consist of the New England States, the Hudson River towns and New York State.

E. W. Ham Electric Company Moves Into New Quarters

The E. W. Ham Electric Company, Worcester, Mass., has moved into a three-story newly constructed reinforced-concrete warehouse and office at 3 Burnside Court, Worcester. The new quarters have a total floor area of about 17,000 sq.ft. and are designed to facilitate rapid service, convenient handling of supplies and improved control of stock volume.

The business of this jobbing house has grown so rapidly of late that a lease for five more years has been signed for the old quarters of the company on Barton Place, covering about 18,000 sq.ft., which will be utilized for storage purposes. The company has recently taken the New England agency for the Aerobell washer, manufactured by the Foote-Burt Company, Cleveland.

Fairbanks, Morse & Company to Expand Indianapolis Plant

Plans are being made by Fairbanks, Morse & Company, manufacturers of generators and other electrical equipment, for the expansion of the Indianapolis plant, according to Linton A. Cox, Indianapolis, attorney for the company. The attorney is asking that the county commissioners of Marion county call a special meeting at an early date and that a public auction sale of county property be conducted by the commissioners.

The company, an Illinois corporation, has operated in Indianapolis several years. The present factory site has 500 ft. frontage at Northwestern Avenue and Twenty-first Street. The property sought is directly across the street from the present plant. A. W. Thompson, general manager of the Indianapolis plant, says it may require a year to complete surveys and plans before actual construction can be started. Engineers for the company say the electrical business has grown in the last five or six years to such a point that the present plant of the company is inadequate.

It has been suggested that the electrical plant of the company be moved and consolidated with either the factory at Beloit, Wis., or that at Three Rivers, Mich. However, Mr. Thompson and others connected with the Indianapolis branch have been assured that the electrical business will be continued in Indianapolis if the additional space for new buildings can be acquired. The Hoosier plant now is valued at slightly below $1,000,000 and employs nearly 800 persons. If the company's expansion project is carried through, more than 3,000 persons will be employed.

To Make and Sell Appliances

The Electrical Utilities Company, Jeffersonville, Ind., recently organized with capital stock of $25,000, announces that it will manufacture and sell electrical devices and appliances. The company is located at 332 Missouri Avenue. Officials of the company are Charles F. Schnatterer, C. J. Fackler, M. D. Phillips, George Reiss, R. L. McGinnis and E. A. Drake.

Kuhlman Sales Appointment

E. N. Hyde, Philadelphia, Eastern district representative of the Kuhlman Electric Company, reports the appointment of Harry W. Motter of York, Pa., as distributor for Kuhlman transformers in several counties of central and southeastern Pennsylvania.

With the addition of Mr. Motter to the field force, prospective buyers will no doubt be able more promptly to get detailed information regarding Kuhlman products, covering as they do high-tension transmission and power distribution transformers for general central-station service and street-lighting transformers which operate without moving coils and without low-power-factor disturbances.

Transformers fit in with the other representations assigned to Mr. Motter by the Howell Electric Motor Company, Marble-Card Electric Company, Electric Machinery Manufacturing Company, Cutler-Hammer Manufacturing Company, Westinghouse Lamp Company and Automatic Fuel Saving Company.

Ledox Storage Battery Firm Opens Brooklyn Branch

The Ledox Storage Company, Inc., 314 Bergen Street, Brooklyn, N. Y., which was recently incorporated with capital stock of $25,000, is manufacturing two makes of storage batteries. This company makes its own plates and castings, but the remainder of the work is let out through contracts. A new place has been opened at 76 Fourth Avenue, Brooklyn, as the main office, salesroom and repair department. Further expansion is contemplated by the company. The officers of the company are: J. Donald Moulton, president; R. B. Stackpole, vice-president, and O. W. Larson, secretary and treasurer.

Elliott-Lewis Company Adds to Sales Force

The Elliott-Lewis Electrical Company, Inc., 1017 Race Street, Philadelphia, distributor for the Trumbull Electric Manufacturing Company, Ansonia Electrical Company and Landers, Frary & Clark, has recently added several new salesmen to take care of its increasing number of orders and to assure better distribution. The company has recently leased 15,000 sq.ft. of additional warehouse space to provide for enlargement in its stock. Frank R. Elliott is president of the firm.

Kubec Electric in New Location

By moving from 506 West Van Buren Street to 628-30 West Jackson Boulevard, Chicago, the Kubec Electric Company has increased its floor capacity 250 per cent. This change went into effect Jan. 1. August Kubec, president, says this expansion affords him better facilities to improve his jobbing lines, especially in the electric industrial tool, industrial fixtures and radio field. He also states that his total business for 1922 was 30 per cent greater than that obtained in 1921. Plans for the incorporation of the company for $75,000 have been made.

Hurley Company Manufacturing 12,000 Washing Machines Monthly

The decrease in the number of domestic servants, as shown by the last census, is not due to the shortage of persons willing to accept this sort of employment, according to Edward N. Hurley, Jr., vice-president of the Hurley Machine Company, Chicago.

"While the census shows that there has been a decrease in the number of persons listing themselves in the domestic service classification," said Mr. Hurley, "a recent survey by the field force of our company shows that more women than ever before are doing their own household work by preference. This is largely due to the increased use of electrical conveniences.

"There are now approximately 2,500,000 washing machines of all makes and types in use in the United States. While the washing machine has been on the market for many years, the full appreciation of this labor-saving device did not come until the period of the war, when thousands of women left domestic employment to go into munition factories.

"Back in 1909 there were only about three thousand electrical washing machines in the United States. Today the Hurley Machine Company alone is manufacturing twelve thousand a month.

"The future possibilities of the industry are shown by the fact that there will be at the end of this year nine and a half million wired homes in the United States."

Bright Outlook for Bosch Firm

The 1923 business outlook for the American Bosch Magneto Corporation is exceedingly bright, announcement having just been made that the Rickenbacker car will hereafter be equipped with Bosch starting, lighting and battery ignition and that Hudson and Essex cars will continue during 1923 to use electrical equipment of the same make.

The Rickenbacker will be equipped with the standard 4-in. Bosch generator, the 4-in. Bosch starting motor and the compensating battery ignition system, which has automatic spark control. Compensating ignition is also used on both Hudson and Essex cars, and each is equipped with the standard Bosch 5-in. generator and 4-in. starting motor.

The supplying of electrical equipment for Hudson and Essex cars during 1922 helped greatly to increase the Bosch corporation's business, and the prospects of a substantial increase in production of these two cars during 1923 holds a promise of still greater business for the American Bosch Magneto Corporation.

The Rickenbacker corporation is also rapidly enlarging its selling organization, and its requirements of Bosch equipment during 1923 will undoubtedly assume substantial proportions.

Pettingell-Andrews Sales Meeting Has Optimistic Tone

Anticipations of an excellent business during 1923 based upon hard work and a growing demand for electrical products on the part of the general public was the feature of the annual sales convention of the Pettingell-Andrews Company, Boston, which was held Jan. 8-10 inclusive. At the opening session Monday the program included addresses by H. S. Schott,, National Carbon Company, Long Island City, N. Y., on "Columbia Batteries," and A. H. Jaeger, Edison Electric Appliance Company, Chicago, on "Appliances." J. E. Livor, sales manager, then threw the meeting open to a general discussion of cooperation by department heads and assistants, and this was continued during the evening.

On Tuesday Messrs. Kennedy and Bowe of the General Electric Company were scheduled to speak on "Insulating Material" and "Tungar Rectifiers," respectively, followed by a talk by J. E. Livor on "Possibilities of G. E. Cooperation." E. N. Hurley, Jr., vice-president, and Messrs. Blye and Root of the Hurley Machine Company, Chicago, were scheduled for addresses upon "Hurley Products." H. F. Wallace, New England manager Edison Lamp Works, and R. B. Parker, assistant sales manager, Edison Lamp Works, Harrison, N. J., on "Lamps." R. S. Yates, Bridgeport, Conn., was scheduled to speak on "Wiring Devices;" R. P. Heaney, Schenectady, on "Fans," and A. L. Atkinson, Bridgeport, was also to speak.

The closing event scheduled was a dinner at the Exchange Club, Boston, on Wednesday evening, the program including talks by F. S. Price, president of the company; George Baldwin, merchandising manager General Electric Company, and David Saranoff of the Radio Corporation of America. A feature was a "radio sketch" of the Pettingell-Andrews and General Electric company a decade ago and today.

Worcester Sales Agency Opened by McGrail Interests

Interests identified with the McGrail Electric Company, Worcester, Mass., have opened a new fixture and supply house at 442 Main Street, Worcester, under the name of the Sunset Light & Power Company. The establishment is under the management of John E. McGrail. The company plans to retail and to distribute Hotpoint appliances, Hamilton-Beach vacuum cleaners, "Easy" washers, "American Beauty" irons, Simplex heaters and pads, Riddle fixtures and "Lightoliers."

The Re-New Lamp Company, Malden, Mass., manufacturer of carbon and tungsten lamps, has changed its corporate name to the Economic Lamp Company. Officials state there has been no change in the management or policy of this company, and that the change seemed desirable to them because, as manufacturers of new lamps, the name Re-New Lamp Company gave a wrong impression as to their product.

N. A. Strand & Company, manufacturers of electric vibrators and other machinery, 631 West Jackson Boulevard, Chicago, are taking bids on a two-story factory, 79 ft. x 80 ft., at Argyle and Lincoln Streets, to cost $50,000.

The Battery Products Company, 5425 South State Street, Chicago, recently incorporated with $100,000 capital stock, is a continuation of the former Battery Parts Company, same address. It manufactures storage-battery-charging clips, battery terminals, connections and cable leads, and recently completed an addition which is being used as a foundry.

Electric Appliances, Inc., Muncie, Ind., an outgrowth of a purchase recently made of the Sterolectric Company, through a receiver, has been incorporated with a capital stock of $50,000, to manufacture electrical heating and cooking devices.

The Standard Underground Cable Company, Westinghouse Building, Pittsburgh, Pa., announces that it moved the Boston sales office of the company from its former location in the Delta Building to 609 Unity Building, 185 Devonshire Street, Boston, on Jan. 1.

The Mueller Electric Company, Cleveland, manufacturer of electric specialties, has recently moved into its new building at 1583 East Thirty-first Street, where production will be carried on in greater volume.

The Federal Lighting Fixture Manufacturing Corporation, 35 North Ninth Street, Philadelphia, has leased property at 33 North Eleventh Street, Comprising two complete floors, for expansion.

The National Electric Service Corporation, organized in Denver, Colo., in the spring of 1922 and manufacturing the Nesco radio equipment, has declared a 5 per cent cash dividend, payable Dec. 20 to stockholders of record of Dec. 15.

The Wisconsin Cabinet & Panel Company, a subsidiary of Thomas A Edison, Inc., West Orange, N. J., has plans for a two-story addition to its plant at New London, Wis., to be 72 ft. x 100 ft. and estimated to cost $60,000.

The Safety Car Heating & Lighting Company, Dixwell Avenue, New Haven, Conn., manufacturer of electric heating and lighting equipment for railroad cars, will build a one-story addition, 106 ft. x 115 ft.

Wood & Weber, Denver, Col., engineers, have recently moved their office to 507 Tramway Building, where additional space is provided for their activities.

The Bead Chain Manufacturing Company, Bridgeport, Conn., manufacturer of brass chain for electric lighting service, has announced that it has increased its capital stock from $50,000 to $300,000.

The Western Electric Company branch at Portland, Ore., is now occupying its new three-story office and warehouse building at West Park and Flanders Streets, Portland.

A. B. Faulkner, 720 Fifth Avenue, Williamsport, Pa., is planning for the establishment of a factory to manufacture electric outdoor operating displays.

O. H. Sebring, who recently began the erection of a plant in Sebring, Ohio, for the manufacture of aluminum ware, has decided to make instead a line of electrical supplies. A building 70 ft. x 140 ft. will be occupied by this business.

The Electrical Dealers' Supply Company, 162 West Randolph Street, Chicago, will erect a three-story factory, to contain 45,000 sq.ft. of floor space, in Diversey Boulevard near Oakley Avenue. This building, it is estimated, will cost $150,000.

Guy Dillon, Indianapolis, has arranged for the establishment of a one-story factory for the manufacture of wireless and equipment at 150 Virginia Avenue.

The Electric Machinery Manufacturing Company, Thirteenth and Tyler Streets, N. E., Minneapolis, Minn., will soon take new bids on revised plans for the construction of a two-story plant. Bids recently received have been rejected. Silas McClure is president.

The Modern Electric & Machine Company, Indianapolis, Ind., has arranged for an increase in capital from $35,000 to $110,000 for proposed expansion.

The B-R Electric Company, Fifteenth and Walnut Streets, Kansas City, Mo., has commenced the erection of a new five-story and basement building at 1411 Walnut Street for general distributing and operating service. It is expected to be ready for occupancy early in the Spring.

Foreign Trade Notes

FUNDS PROVIDED FOR AN ELECTRIC PLANT IN JAMAICA.—Under a law which became effective on Aug. 11, 1922, *Commerce Reports* states, public improvements, including an electric plant to supply electricity for power purposes and for lighting streets, roads, government buildings and institutions in the cities of Kingston and St. Andrew, Jamaica, were authorized. A loan of £428,000, to be raised by the Kingston General Commissioners, will cover the cost of these improvements.

PROPOSED RADIO SYSTEM IN ARABIA.—Plans are under consideration by local promoters, according to *Commerce Reports*, for connecting Aden, Khokha, Mocha and Hodeidah by wireless. The maximum distance is about 250 miles, and the promoters desire to secure estimates of cost of construction and other information. The same parties desire catalogs covering lighting sets using kerosene engines.

ASH AND DUST EXTRACTION PLANT FOR MORWELL (AUSTRALIA) POWER SCHEME.—Tenders will be received by the State Electricity Commission of Victoria, Melbourne, Australia, until March 7 for an ash and dust extraction plant for the Morwell power scheme (Specification No. 23/6). R. Liddelow is secretary of the commission.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in Cuba (No. 4,926) of ornamental interior electric lighting fixtures.

Purchase is desired in Chile (No. 4,934) of transmitting and receiving radiophone apparatus. Descriptive literature and prices of apparatus easy to install and operate are required.

Purchase and agency is desired in Australia (No. 4,953) for refrigerating machines for household and hotels.

Purchase is desired in Cuba (No. 4,961) of storage batteries, parts and accessories, and machinery and apparatus for the manufacture of storage batteries.

Purchase is desired in Switzerland (No. 4,965) of electric machine to solder fine silver wires onto tinplated brass heads of fusible lamelles.

Purchase is desired in Italy (No. 4,970) of both hand-driven and motor-driven knitting machines for the manufacture of hosiery.

THE EASTERN ELECTRIC & TRADING COMPANY, P. O. Box 459, Hornby Road, Fort Bombay, India, is in the market for individual radio transmitting and receiving sets, also commercial duplex wireless telephone sets, capable of working from 26 miles to about 300 miles, and also for automatic telephone switchboards.

New Apparatus and Publications

LAMP-MAKING MACHINE.—A unit lamp-making machine for producing miniature, vacuum and nitrogen lamps, tipped or tipless, has been brought out by the General Engineering & Supply Company, 160 Fifth Avenue, New York City.

AUTOMATIC ELECTRIC STOVE.—The Toledo Cooker Company, Toledo, Ohio, has placed on the market an automatic electric stove, known as the "To-Lectric."

ELECTRIC TEST UNIT.—An improved model of testing unit for making tests on starting, lighting and ignition systems has been developed by the Service Products Company, Springfield, Ohio.

ELECTRIC LAUNDRY STOVES.—The George D. Roper Construction Company, Rockford, Ill., has brought out a line of electric laundry stoves with two or three burners.

PORTABLE DESK LAMP.—A portable desk or table lamp of solid brass ("Verdelite") furnished with a pen rack and inkwell has been brought out by the Faries Manufacturing Company, Decatur, Ill.

OUTDOOR LIGHTING CONTROL.—The South Bend Current Controller Company, South Bend, Ind., has issued a new and revised edition of its "Engineer's Reference Book," which deals with the remote control of all phases of outdoor lighting from a power house by means of the "R-C-O-C" system of remote control. It contains typical plans, data for solving problems connected with control of constant-current transformers, multiple or series ornamental lighting systems, etc.

TELEPHONICS.—The Western Electric Company, Inc., Engineering Department, New York City, is distributing reprints B-13-1, B-15-1, B-19-1 and B-20-1, entitled "Voltage-Current Relation in Central Anode Photo-Electric Cells." "The Crystal Structures of Potassium and Beryllium." "The Relative Sensitivity of the Ear" and "Thermionic Work Function of Tungsten" respectively.

STEAM TURBINES, PUMPS, BLOWERS, ETC.—"Plant and Products" is the title of a twenty-four-page booklet issued by the De Laval Steam Turbine Company, Trenton, N. J., covering its single-stage and multi-stage turbines, centrifugal pumps, blowers and other products.

SAWMILL EQUIPMENT.—"Electrically Driven Sawmills" is the title of bulletin No. 140 issued by the Allis-Chalmers Manufacturing Company, Milwaukee, covering its equipment for electrically driven machinery for sawmills. Illustrations are also given of various sawmills equipped with "Allis-Chalmers" machinery.

PORTABLE AMMETERS AND VOLTMETERS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing a folder entitled "Handy Instruments for Everyday Use," giving information for instrument users about its line of portable ammeters and voltmeters.

FEED-WATER HEATERS.—"Feed Water Heaters in Their Relation to Steam-Plant Efficiency" is the title of a sixty-page booklet distributed by the H. S. B. W. Cochrane Corporation, Philadelphia, which is a presentation of the theory and practice of heating boiler-feed water.

OIL ENGINE.—The Ingersoll-Rand Drill Company, 11 Broadway, New York City, has recently placed on the market a horizontal direct-injection oil engine.

FLEXIBLE SHAFTING.—The Stow Manufacturing Company, Binghamton, N. Y., is manufacturing a flexible shafting which can be used with any portable electric drill.

PORTABLE CORD.—"Okocord" is the name of a new flexible, unbraided, portable cord, recently placed on the market by the Okonite Company, Passaic, N. J.

RADIO APPARATUS.—The Coto-Coil Company, 87 Willard Avenue, Providence, R. I., has recently developed a new vacuum-tube socket, known as type 7,000.

SOLDERING MACHINE.—The P. E. Chapman Electric Works, Tenth and Walnut Streets, Philadelphia, have recently developed the "Allatonce" commutator soldering machine, which is described in bulletin No. 120.

WATER HEATER.—The Automatic Electric Heater Company, Warren, Pa., has brought out an improved-type "Sepco" automatic circulation water heater. This heater differs from previous models in that the heating units are inserted from the top. Another feature is the use of separate 1,000-watt units instead of placing 3,000 watts all on one unit-head assembly, and still another is the telltale of glow fuse.

RADIO APPARATUS.—The Dayton Fan & Motor Company, Dayton, Ohio, has brought out a line of molded variometers and vario-couplers.

VARIABLE CONDENSER.—The Mignon Electric Manufacturing Corporation, 25 South Water Street, Rochester, N. Y., has developed a variable condenser.

New Incorporations

THE WEST TEXAS UTILITIES COMPANY, Abilene, Tex., has been chartered with a capital stock of $1,500,000 to furnish gas and electricity in thirty-four counties in western Texas. The incorporators are G. W. Fry, Taylor County; E. W. Campbell, Eastland County, and M. J. Insull, Chicago.

THE GREAT NORTHERN UTILITIES COMPANY, Great Falls, Mont., has been incorporated with a capital stock of $3,000,000 to supply electricity for lamps and motors in this part of the state. The directors are F. D. Fletcher, J. F. Mooney and O. C. Allan, all of Great Falls.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

PORTLAND, ME.—The Maine Central Railway Company contemplates power-house extensions in connection with its proposed car and locomotive shops at its South Portland terminal, to cost about $1,200,000.

WATERVILLE, ME.—The industrial concerns and water-power companies which utilize the waters of the Kennebec River are reported to have united on a project to double the available water power of that stream by establishing storage basins. The proposed plan contemplates the establishment of a large basin along the Dead River in the Flagstaff district. Should the Dead River project be delayed, the other site which is contiguous to Brassau Lake in the Moosehead region, would be devoloped first.

NEW HAVEN, CONN.—Plans are being prepared by Day & Klauder, Architects, 416 Chestnut Street, Philadelphia, for a one-story power house at the building now in course of erection at 19 Rose Street.

STAMFORD, CONN.—Contract has been awarded by the Stamford Gas & Electric Company for the construction of a switch house, to cost about $50,000.

Middle Atlantic States

AMSTERDAM, N. Y.—The Adirondack Power & Light Corporation, it is reported, will build a new plant on East Canada Creek, below Canada Lake, to cost about $750,000. This plant will be connected with the present transmission system near St. Johnsville.

BINGHAMTON, N. Y.—Extensive improvements are contemplated by the Binghamton Light, Heat & Power Company, involving an expenditure of about $1,000,000, during the coming year. The work will include the installation of a 10,000-kw. turbine and three 600-hp. boilers with auxiliary equipment at the main power station at Johnson City, to cost about $850,000. The power station will be doubled in size, and another brick stack, 150 ft. high, will be erected.

BROOKLYN, N. Y.—The Rubel Coal & Ice Corporation, Glenmore Avenue, will install electric power equipment at its proposed ice-manufacturing plant on Eighteenth Avenue, to cost about $500,000. Edward M. Adelsohn, 1778 Pitkin Avenue, is architect.

BUFFALO, N. Y.—The International Railway Company contemplates rebuilding its Cold Spring car shops and barns, recently destroyed by fire.

BUFFALO, N. Y.—Bids will be received by the Board of Education until Jan. 18 for electrical and machine equipment for the vocational and technical schools. D. J. Sweeney is deputy superintendent of business and accounts.

CALCIUM, N. Y.—Steps have been taken by the Citizens' Protective Association to secure electrical service in Calcium from the Northern New York Utilities, Inc., Watertown. Madison Cooper is president of the association.

DUNKIRK, N. Y.—Plans are under consideration for the installation of electrically operated pumping machinery at the waterworks station.

GENEVA, N. Y.—The Empire Gas & Electric Company has acquired the right-of-way for a new high-tension electric transmission line between this city and Lyons, where it will connect with the system of the Niagara, Lockport & Ontario Power Company. The new line will also supply electricity to communities and farms along the route, including Junius, Alloway, Thompson's and other towns.

MAPLETON, N. Y.—Arrangements have been made with the Tonawanda Power Company, North Tonawanda, to furnish electricity in Mapleton. The transmission line will be extended a distance of 4 miles in the spring to furnish the service.

NEW YORK, N. Y.—The Arctic Hygeia Ice Manufacturing Company, 300 East One Hundred and Thirty-third Street will

install electric power equipment in connection with extensions to its plant, to cost about $450,000. Ophuls & Hill, 112 West Forty-second Street, New York, are engineers.

NEW YORK, N. Y.—Electric power equipment will be installed at the confectionary plant to be erected by Henry Heide, 313 Greenwich Street, on Van Dam Street, to cost about $500,000. Maynicke & Frank, 25 East Twenty-sixth Street, are architects.

UTICA, N. Y.—The Utica Gas & Electric Company contemplates placing its wires on Bleecker Street underground.

GLOUCESTER CITY, N. J.—Electrically operated pumping machinery will be installed in connection with proposed waterworks extensions, to cost about $250,000.

NEWARK, N. J.—The Board of Education contemplates the installation of additional equipment in the electrical department and shop at the Seymour vocational school.

ALTOONA, PA.—Officials of the Penn Central Power Company have organized the Central Transmission Company, to take over eleven of its subsidiary companies operating in central Pennsylvania. The new company will build a transmission system from the power plant of the Penn Central Company at Saxton, now in course of construction.

COATESVILLE, PA.—Improvements are contemplated by the Chester Valley Electric Company, including the erection of a new boiler house and installation of new boilers, to cost about $125,000. The erection of additional high-tension lines is also under consideration by the company.

MOUNT HOLLY SPRINGS, PA.—The Cumberland Valley Light & Power Company has secured contracts for light and power service in York Springs, East Berlin, Abbottstown and Bendersville.

PHILADELPHIA, PA.—Electric power equipment will be installed at the proposed paper manufacturing plant to be erected on South Street, by S. Kardon, Second and Vine Streets, to cost $500,000. Clarence E. Wunder, 1415 Locust Street, is architect.

PHILADELPHIA, PA.—The Schlorer Delicatessen Company, 1909 South Front Street, will install electric equipment at its proposed factory at Water and Mifflin Streets, to cost about $200,000. Clarence E. Wunder, 1415 Locust Street, is architect.

SHENANDOAH, PA.—The Pennsylvania Power & Light Company is making surveys for a transmission line to Shenandoah via Hometown and Delano. Service will be furnished from the Hauto power plant.

STRASBURG, PA.—The Edison Electric Company, Lancaster, has acquired the Strasburg Electric Light Company and will merge the property with its system. Extensions and improvements are planned.

BALTIMORE, MD.—The Washington, Baltimore & Annapolis Railway plan to extend its transmission line to Laurel for light and power service. A distributing system will also be installed at Harmans.

BALTIMORE, MD.—Electric power equipment will be installed in the printing plant to be erected by the Baltimore American, Courtland and Centre Streets, to cost about $450,000. McKim, Mead & White, 101 Park Avenue, New York, are architects.

BLUEFIELD, W. VA.—The Coal River Collieries Company plans to install electrically operated machinery and power equipment at its properties.

BLACKSBURG, VA.—Bids will be called early in February for an addition to the power house at the Virginia Polytechnic Institute, to cost about $55,000. Wiley & Wiley, People's Bank Building, Lynchburg, are engineers.

MARTINSVILLE, VA.—The Lester Lumber Company plans to build a power house in connection with the rebuilding of its local plant, recently destroyed by fire, causing a loss of about $250,000.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until Jan. 22, for telephone supplies. (Circular PR 13360-43 CP.)

North Central States

CHEBOYGAN, MICH.—The property of the Cheboygan Light & Power Company has been acquired by the Commonwealth Light & Power Company, 141 Broadway, New York. Extensions and improvements are planned.

DETROIT, MICH.—The Board of Education contemplates the construction of a central power house on the Roosevelt Field for service at a number of schools, to cost $150,000.

DETROIT, MICH.—Plans are being prepared by Edward Gray, engineer, foot of Continental Avenue, for the construction of a central power plant, in Detroit.

BELLAIRE, OHIO—The Central Coal Mining Company, Charleston, W. Va., plans to equip its local properties for electrical operation.

DAYTON, OHIO—Plans are being prepared by the A. C. Bishop Company, architect and engineer, Guardian Building, Cleveland, for a plant for the Miami Ice & Fuel Company, Ludlow Building, to cost about $250,000.

DOVER, OHIO.—The American Gas & Electric Company has acquired the plant and property of the Ohio Service Company and plans extensions and improvements.

LIMA, OHIO—An agreement has been reached between the City Council and the Ohio Power Company, which has recently acquired the local system, whereby 200 additional street lamps will be installed in various parts of the city.

GEORGETOWN, KY.—The power house of the Georgetown Water, Gas, Electric & Power Company was recently damaged by fire, causing a loss of about $50,000.

LAWTON, KY.—The Enterprise Chemical Company, P. O. box 545, Huntington, W. Va., recently organized, will build a power plant in connection with its proposed local lime-manufacturing plant. William Lewis is construction engineer.

EVANSVILLE, IND.—The Southern Indiana Gas & Electric Company plans extensions and improvements during the present year, to cost about $500,000.

CHICAGO, ILL.—Extensions will be made to the power house at the Michael Reese Hospital, Twenty-ninth Street and Ellis Avenue, in connection with a new nurses' home. Schmidt, Garden & Martin, 104 South Michigan Avenue, are architects.

JOLIET, ILL.—The Public Service Company of Northern Illinois will begin work at once on the proposed addition to its power plant.

OTTAWA, ILL.—Plans are being prepared by the Waterway Division, of the State of Illinois, 304 South Wabash Avenue, Chicago, for a new power house at Ottawa in connection with locks and dam on the state waterway. W. L. Sashett is superintendent.

HARTFORD, WIS.—The Westphal Milk Products Company has purchased the Denison millpond which it proposes to utilize for the development of hydro-electric power.

HUDSON, WIS.—The Stanton-Star Prairie Power Company, recently organized, plans to erect a transmission line to furnish electricity for lamps and motors to the farming sections north and east of the city. Energy for distribution will be purchased from the New Richmond Roller Mills Company of Hudson.

PORT EDWARDS, WIS.—The Nekoosa-Edwards Paper Company is planning to install a new 1200-hp. hydro-electric unit at the Nekoosa mill to furnish power for the new paper mill now under construction. Two steam turbines of about 3,000 hp. capacity, will also be installed by the company, one at Nekoosa and the other at Port Edwards, as auxiliaries. Other electrical equipment will also be required at the Nekoosa mill.

PORT WASHINGTON, WIS.—The town officials have applied to the Railroad Commissioners for permission to extend the municipal electric light and power lines to the town of Holland to supply electricity in the latter place.

RACINE, WIS.—The Board of Aldermen has decided to replace the arc lamps (416) now in use with 600-cp. nitrogen electric lamps. The Wisconsin Gas & Electric Company furnishes the street-lighting service.

SHEBOYGAN, WIS.—The Eastern Wisconsin Electric Company has applied to the State Railroad Commission for permission to issue $239,000 in capital stock and $3,099,000 in bonds, the proceeds to be used for retiring underlying bonds and proposed extensions and improvements.

MAPLETON, IOWA.—Bonds for $50,000 have been approved for improvements to the municipal electric plant.

MOUNT VERNON, IOWA.—Electric equipment will be installed in connection with improvements at the municipal waterworks pumping plant.

GALENA, MO.—Application has been made to the Federal Power Commission by B. J. Diemer and John Meyer, Springfield, and John A. Williams, Aurora, for permission to construct a hydro-electric plant, in Galena, to cost about $100,000.

LAMAR, MO.—Bids will be received at the office of the Lamar water and electric plant until Jan. 15 for furnishing additional power equipment, consisting of an engine or engines with direct-connected generators, for the municipal electric light plant. J. M. Earp, is Mayor and chairman of utilities committee.

PURDY, MO.—Bonds to the amount of $12,000 have been voted for extensions and improvements to the municipal electric plant and system.

SPICKARD, MO.—Bonds to the amount of $15,000 have been sold for the erection of a transmission line from Trenton to supply electricity in Spickard.

McLAUGHLIN, S. D.—Application has been made to the Council by E. M. Young for the installation of an electric light plant in McLaughlin.

PICKRELL, NEB.—Plans are under way for the erection of a transmission line to Beatrice to supply electricity in Pickrell.

BONNER SPRINGS, KAN.—The International Cement Corporation, 342 Madison Avenue, New York, contemplates an addition to the power plant at its local mills, in connection with extensions, to cost about $500,000.

WICHITA, KAN.—Electric equipment will be installed in the printing plant to be erected by the McCormick-Armstrong Press on Ellis Street, to cost about $100,000. Lorentz Schmidt & Company, Fourth National Bank Building, are architects.

Southern States

BOSTIC, N. C.—Bonds to the amount of $4,000 have been authorized for the installation of an electric lighting and power system. A transmission line will be erected to Forest City to connect with the lines of the Southern Power Company at that place.

DENMARK, S. C.—The Edisto Public Service Company plans to double the capacity of its electric and ice plants.

HARBOR POINT (P. O. ALLANDALE), FLA.—The Harbor Point Development Company has acquired three partially developed tracts of land about 5 miles south of Daytona, comprising Norwood, Allandale and Rose Bay, aggregating 1,400 acres, which it will develop for homesites. Lighting, water and sewer systems will be installed. Charles D. Thompson is local manager in charge with offices in Nelson Building, Daytona.

TAMPA, FLA.—R. W. Pillsbury, president, Woodmont Orchards Company, New Hampshire has purchased the holdings of the Anna Maria Beach, including pier, dance hall and equipment for maintenance of an amusement resort, and contemplates improvements including an electric lighting system, etc. Bouton & Cermak, St. Petersburg, are representing agents.

MEMPHIS, TENN.—The Memphis Light & Power Company is negotiating for the purchase of the properties of the Memphis Street Railway Company. As soon as the receivership is cleared up it will enlarge the power house of the street railway and make other extensive improvements.

UNION, TENN.—The proposal to issue $125,000 in bonds will be submitted to the voters on Jan. 27. Of the proceeds $75,000 will be used for extensions to the municipal light and water plant and sewer system.

CHICKASHA, OKLA.—The Chichasha Gas & Electric Company has submitted proposals and has asked for franchises to serve electricity to the towns of Cement, Cyril, Tuttle, Minco, Pocasset, Ambler and Alex.

PAWNEE, OKLA.—The Oklahoma Gas & Electric Company plans to extend its 22,000-volt transmission line to Pawnee for commercial service. A line will also be erected to Cushing.

WEST TULSA, OKLA.—The Oklahoma Power Company, Tulsa, will soon break ground for the construction of a new 10,000-kw. unit at its local power plant, duplicating the unit now in course of erection.

DALLAS, TEX.—The Dallas Railway Company will construct two substations in connection with the electrification of the line of the Missouri, Kansas & Texas Railway Company from Dallas to Denton.

ELECTRA, TEX.—The Griswold Oil Company, Henrietta, contemplates the construction of a substation at its proposed oil refinery here, to cost about $500,000.

JACKSONVILLE, TEX.—The Jacksonville Electric & Ice Company has increased its capital stock to $135,000.

PORT ARTHUR, TEX.—The Gulf Refining Company, Dallas, contemplates the installation of additional power equipment in connection with extensions to its local refinery, to cost about $500,000.

Pacific and Mountain States

CENTRALIA, WASH.—The H. H. Martin Lumber Company will install a substation in connection with a new mill, to cost about $100,000.

COLVILLE, WASH.—The Stevens County Power & Light Company contemplates extending its transmission lines 3 miles south of Kettle Falls.

SEATTLE, WASH.—A preliminary permit has been granted by the Federal Power Commission to Maurice D. Leehy, Seattle, involving a power development at Lake Mahoney and Beaver Lake, 10 miles northeast of Katchikan, Alaska.

FRESNO, CAL.—The installation of a 6,000-hp. generator in power house No. 3 of the Crane Valley system is under consideration by the San Joaquin Light & Power Corporation. An extension, 36 ft. x 85 ft., will be erected at the power house to provide space for the proposed new unit.

HAYWARD, CAL.—Plans are being prepared for the installation of an ornamental lighting system on Castro, B and Main Streets, to be maintained by an underground wire.

LIVERMORE, CAL.—Bids for the construction of twenty-nine buildings at Livermore, including electrical work, refrigerating machinery, etc., for the United States Veterans' Bureau, Arlington Building, Washington, D. C., have been rejected. The work will be readvertised.

LOS ANGELES, CAL.—Ordinances have been approved for the installation of a street-lighting system on North Main Street and on Vermont Avenue.

OAKLAND, CAL.—Steps have been taken by property owners on Webster Street from Fourteenth to Twenty-second Street to secure the installation of electroliers on that thoroughfare.

REDLANDS, CAL.—An ordinance is being prepared for the installation of an ornamental lighting system on Eureka and Grant Streets and Brookside Avenue.

RIVERSIDE, CAL.—Steps have been taken by the officials of the Gage Canal Company for the incorporation of a mutual company for the purchase of power used in pumping water from the Gage Canal to the foothill citrus orchards.

SACRAMENTO, CAL.—The installation of an ornamental lighting system on I Street, to include octagonal electroliers, is under consideration by the City Council.

SAN RAFAEL, CAL.—Negotiations are under way with the Pacific Gas & Electric Company for the installation of an ornamental lighting system in the residential districts.

WATSONVILLE, CAL.—The Watsonville Water & Light Company has petitioned the State Railroad Commission for permission to sell its property to the city of Watsonville, at $200,000. Bonds have been voted to acquire the plant.

PEACH SPRINGS, ARIZ.—A permit has been granted to James B. Girard, engineer, Phœnix, by the State Water Commissioner to build a hydro-electric plant on the Colorado River, at the mouth of Diamond Creek, about 25 miles from Peach Springs. The plans call for a total development of 200,000 hp. Authority from the Federal Power Commission will be necessary before the plant can be erected.

Canada

ANYOX, B. C.—The Granby Consolidated Mining, Smelting & Power Company is building an addition to its local power plant and will install a 5,000-hp. vertical reaction turbine, for which orders have been placed.

VANCOUVER, B. C.—The British Columbia Electric Company is planning to erect a new 34,000-volt transmission line from its Lake Buntzen plant to Port Moody, tying in with an existing line at that point. This line and the reconstruction of other lines will cost about $170,000.

CAMPBELLVILLE, ONT.—The question of issuing $35,000 in bonds for the installation of an electric lighting and power distribution system is under consideration.

LANSING, ONT.—Surveys are being made for the installation of a street-lighting system in North York Township. A. Stocking, Hydro Building, University Avenue, Toronto, is engineer.

Electrical Patents

Announced by U. S. Patent Office

(Issued Dec. 19, 1922)

1,439,524. ELECTRIC HEATER; T. A. Lewis and A. L. Dunham, New York, N. Y. App. filed March 20, 1920. Radiant room heater with element inclosed in glass bulb.

1,439,525. EXCITATION OF ELECTROLYTIC CONDENSERS; R. D. Mershon, New York, N. Y. App. filed Sept. 14, 1920. Excitation of condensers that are to be employed in polyphase circuits

1,439,526. EXCITATION OF ELECTROLYTIC CONDENSERS; R. D. Mershon, New York, N. Y. App. filed July 18, 1917. Single source of excitation current.

1,439,543. ELECTROMAGNETIC DEVICE; H. E. Frost, Cleveland, Ohio. App. filed July 9, 1920. Switch for alternating current.

1,439,562. AMPLIFYING SYSTEM; P. F. Lowell, Washington, D. C. App. filed Sept. 9, 1921. Radio-frequency amplifier transformer.

1,439,563. RADIO-FREQUENCY TRANSFORMER; P. D. Lowell, Washington, D. C. App. filed Sept. 9, 1921. Amplifies efficiently at short wave lengths.

1,439,577. ELECTRIC WATER HEATER; G. Pominville, St. Hyacinthe, Quebec, Can. App. filed Sept. 1, 1920. Adaptable to any type of domestic water tanks.

1,439,633. METHOD OF AND APPARATUS FOR TELEGRAPHIC TRANSMISSION; J. W. Milnor, New York, N. Y. App. filed Sept. 17, 1918. Duplex telegraphic transmission through long submarine cables.

1,439,639. ELECTRIC REGULATOR; T. M. Pusey, Kennett Square, Pa. App. filed Nov. 4, 1920. Voltage regulator for generators.

1,439,648. TROLLEY-WHEEL GUARD; W. Stasiak, Detroit, Mich. App. filed April 12, 1922. Star-shaped guard at each side of wheel.

1,439,657. CONNECTION TERMINAL; R. Zollner, Dresden, Germany. App. filed April 6, 1921.

(Issued Dec. 26, 1922)

1,439,686. MAGNETIC FISHING TOOL FOR WELLS; A. H. Brandon, Toledo, Ohio. App. filed May 10, 1919. Relates to electromagnetic fishing operations.

1,439,687. FISHING TOOL; A. H. Brandon, Self-energizing unit attached to drilling stem.

1,439,723. NUMBERING SYSTEM FOR AUTOMATIC TELEPHONE EXCHANGES; W. G. Blauvelt, New York, N. Y. App. filed Sept. 17, 1918. Automatic switching machinery.

1,439,729. TELEPHONE HAND SET; G. Deakin, Antwerp, Belgium. App. filed Sept. 7, 1922. Impulse sender easily attached or removed.

1,439,735. TELEPHONE EXCHANGE SYSTEM; E. W. Hancock, New York, N. Y. App. filed Oct. 20, 1920. Automatic switching.

1,439,740. TROLLEY-POLE BASE; E. S. Lincoln and Ernest Larsson, Mansfield, Ohio. App. filed March 25, 1922.

1,439,761. SIGNAL AND ALARM SYSTEM; C. J. Rohland, Worcester, Mass., and J. H. Wheelock, Fitzwilliam, N. H. App. filed Feb. 5, 1915. Fire-alarm system.

1,439,771. SIGNAL-CONTROLLING SYSTEM; C. A. Sprague, East Orange, N. J. App. filed Feb. 27, 1920. Correcting defective or false response of receiver systems.

1,439,772. SIGNALING APPARATUS AND CIRCUITS; J. F. Toomey, New York, N. Y. App. filed April 24, 1919. Indicates that portion of long telephone line is in use.

1,439,785. TELEPHONE RECEIVER OF THE WATCHCASE TYPE; F. W. Andrew, Brooklyn, N. Y. App. filed April 20, 1922.

1,439,797. GENERATOR DRIVING; W. L. Conwell, Montclair, and W. I. Thomson, Newark, N. J. App. filed Dec. 5, 1918. Railway car-lighting generator belt supplied with sand to prevent slipping.

1,439,817. ANNUNCIATOR DROP; C. Herrmann, New York, N. Y. App. field Oct. 24, 1919.

1,439,871. MOTOR CONTROLLER; L. P. Coulter, Milwaukee, Wis. App. filed Feb. 13, 1922. For machines having several tool-operating motors and a motor-operated feeding mechanism.

1,439,892. MOTOR CONTROLLER; A. J. Horton, White Plains, N. Y. App. filed Nov. 24, 1917. Automatically accelerates to a number of predetermined speeds.

1,439,893. BATTERY-CHARGING APPARATUS; A. J. Horton, White Plains, N. Y. App. filed Jan. 17, 1920. Prevents improper connection to charging circuit.

1,439,947. ELECTRICAL SIGNALING; L. Cohen, Washington, D. C. App. filed June 29, 1921. Static in radio receiving balanced out by Wheatstone bridge.

1,439,955. CATHODE; M. E. Fuld, Baltimore, Md. App. filed Sept. 21, 1920. Dry-cell cathode of wire with depolarizing material.

1,439,956. BATTERY CELL; M. E. Fuld, Baltimore, Md. App. filed June 23, 1919. Cap-shaped anode for dry cell.

1,439,962. TUBE-WELDING MACHINE; E. Kamper, Toledo, Ohio. App. filed June 21, 1917. Preheating the parts of tube to be welded.

1,439,965. ELECTRICALLY HEATED UTENSIL; J. F. Lamb, New Britain, Conn. App. filed July 20, 1917. Waffle iron.

1,439,972. ELECTRIC ARC WELDING; P. O. Noble, Schenectady, N. Y. App. filed Dec. 20, 1920. Flux-covered electrode welding performed with automatic machine.

1,439,979. ELECTRICALLY HEATED DEVICE; E. H. Richardson, Ontario, Cal. App. filed Feb. 21, 1921. Automatic cut-out for flatirons.

1,439,990. VENTILATION FOR DYNAMO-ELECTRIC MACHINES; H. S. Baldwin, Lynn, Mass. App. filed March 5, 1921. Fan attached to one end of machine forces air through windings.

1,439,994. PROCESS OF STABILIZING STORAGE-BATTERY ELECTRODES; R. C. Benner, Bayside, N. Y. App. filed April 29, 1922. Method for washing and drying formed negative plates.

1,439,995. INDUCTANCE; L. F. Bird, Seattle, Wash. App. filed Jan. 5, 1921. For radio circuits.

1,439,997. INSULATION MOUNTING; L. F. Bird, Seattle, Wash. App. filed Feb. 25, 1921. For low-capacity and low-inductance resistances.

1,440,005. PORTABLE BURGLAR ALARM; F. Crossman, San Francisco, Cal. App. filed Aug. 16, 1921.

1,440,021. ELECTRIC POCKET LAMP; A. Luzy, Paris, France. App. filed July 29, 1920. Self-contained generator.

1,440,023. STORAGE BATTERY; S. M. Meyer and W. James, Brooklyn, N. Y. App. filed Oct. 29, 1921. Positive electrode in form of box with perforated sides.

1,440,024. STORAGE BATTERY; S. M. Meyer and W. James, Brooklyn, N. Y. App. filed April 7, 1922. Cylindrical container inclosing cylindrical electrodes.

1,440,036. METHOD OF RECEIVING TELEGRAPH SIGNALS; C. H. Teegarden, Washington, D. C. App. filed Sept. 19, 1918. Supplementary receiving set which may be attached to duplex telegraph system without interference.

1,440,044. COIL-WINDING MACHINE; S. R. Wright, Rawdon, England. App. filed Aug. 22, 1921. Used for winding conical coils.

1,440,051. STARTING GENERATOR FOR INTERNAL-COMBUSTION ENGINES; S. G. Baits, Detroit, Mich. App. filed Nov. 12, 1920.

1,440,078. TELEPHONE LOCK; W. F. Hemstreet, Brooklyn, N. Y. App. filed Feb. 16, 1921. Prevents unauthorized use of automatic telephone.

1,440,091. ELECTRODE; R. A. Long, Tamaqua, Pa. App. filed March 1, 1922. Platinum faced on lead for electrolytic solution.

1,440,093. TROLLEY SHOE; J. Miller, Amesbury, Mass. App. filed Nov. 13, 1915. Self-adjusting, spring-held trolley harp.

1,440,106. PROCESS AND APPARATUS FOR ELECTRIC SMELTING OF ORES; E. H. Rothert, Seattle, Wash. App. filed June 14, 1921. Refining done in same furnace in which ore has been reduced.

1,440,110. TRUNK CIRCUITS; C. Sparks, Chicago, Ill. App. filed April 4, 1918. Provided with double supervision.

1,440,111. TELEPHONE SYSTEM; C. Sparks, Oak Park, Ill. App. filed May 23, 1918. Balanced operator's telephone circuit reduces side tone in the operator's head receiver.

1,440,112. TELEPHONE SYSTEM; C. Sparks, Oak Park, Ill. App. filed July 1, 1918. Multiple-line lamp system in which instantaneous "disconnect" and recall are provided.

1,440,113. TELEPHONE SYSTEM; C. Sparks, Chicago, Ill. App. filed May 15, 1916. Busy test for multiple-line jack and line lamp system.

1,440,114. TELEPHONE SYSTEM; C. Sparks, Oak Park, Ill. App. filed Aug. 5, 1918. Interconnection of common-battery and local-battery lines.

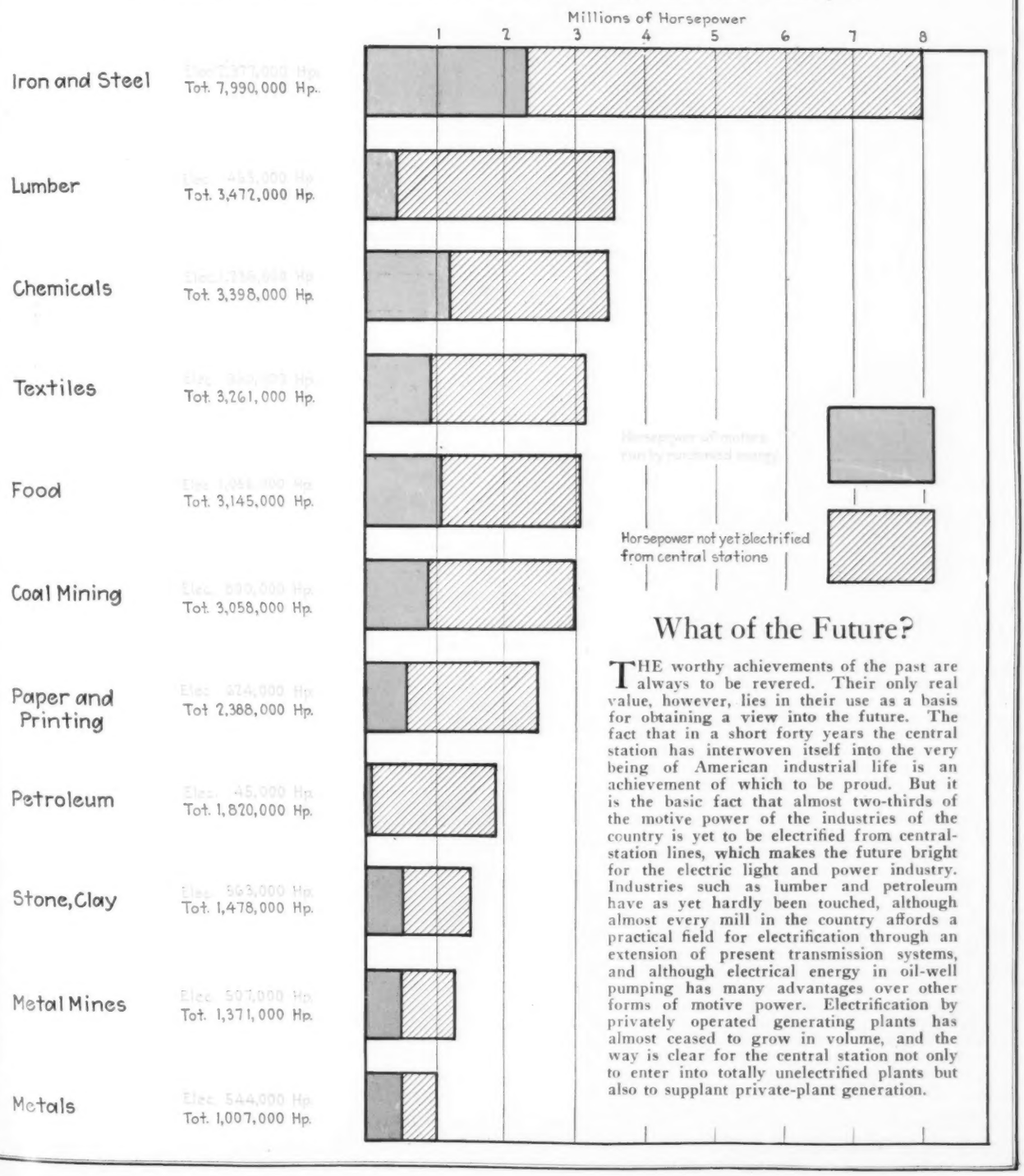
1,440,171. ELECTRIC HEATER; A. Papini, Philadelphia, Pa. App. filed April 21, 1920. Expansion and contraction of thermostatic element employed to oscillate reflector.

1,440,202. ELECTRICAL HEATING UNIT; J. S. Yoast, Cincinnati, Ohio. App. filed April 21, 1921. Loosely packed resistance-element refractory container.

Business Facts for Electrical Men

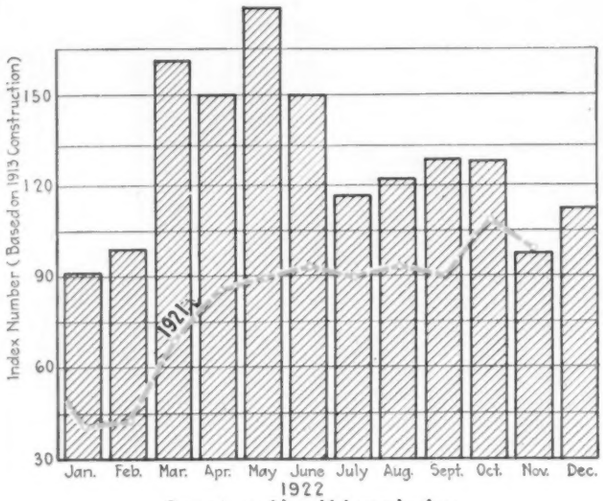
Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

The Industrial Field of the Central Station is Only One-third Developed

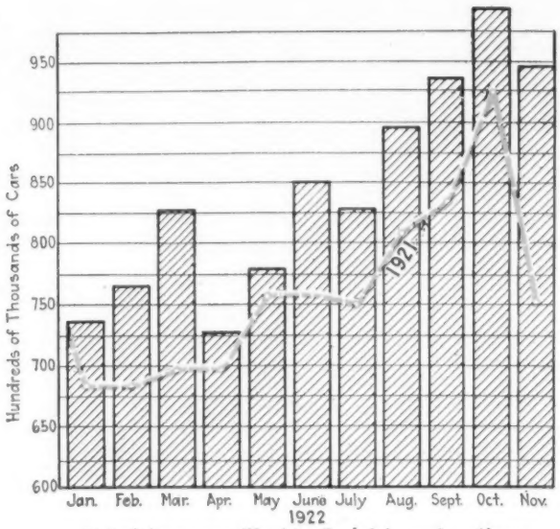


What of the Future?

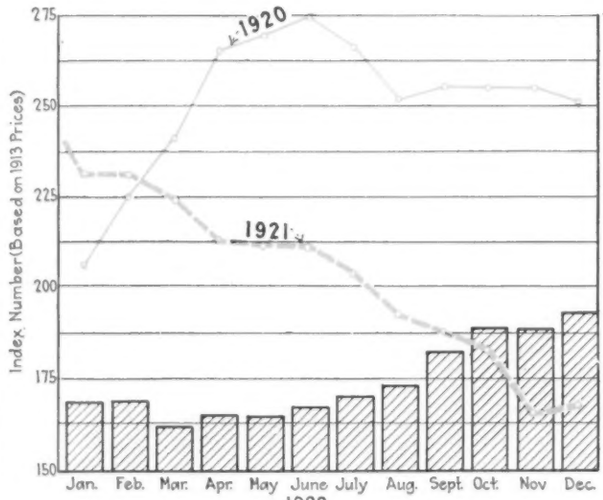
THE worthy achievements of the past are always to be revered. Their only real value, however, lies in their use as a basis for obtaining a view into the future. The fact that in a short forty years the central station has interwoven itself into the very being of American industrial life is an achievement of which to be proud. But it is the basic fact that almost two-thirds of the motive power of the industries of the country is yet to be electrified from central-station lines, which makes the future bright for the electric light and power industry. Industries such as lumber and petroleum have as yet hardly been touched, although almost every mill in the country affords a practical field for electrification through an extension of present transmission systems, and although electrical energy in oil-well pumping has many advantages over other forms of motive power. Electrification by privately operated generating plants has almost ceased to grow in volume, and the way is clear for the central station not only to enter into totally unelectrified plants but also to supplant private-plant generation.



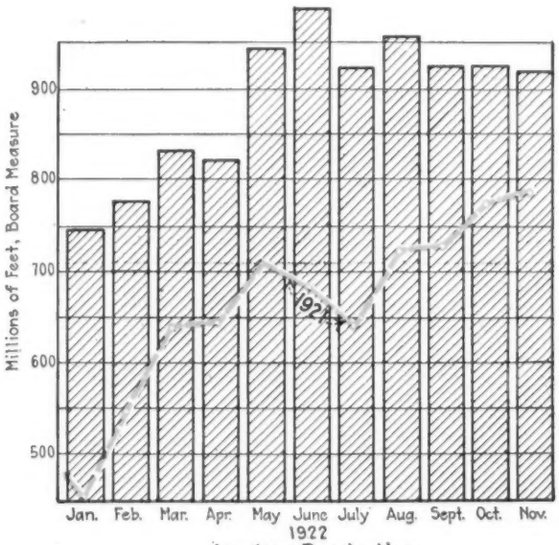
Construction Volume Index
(Engineering-News Record)



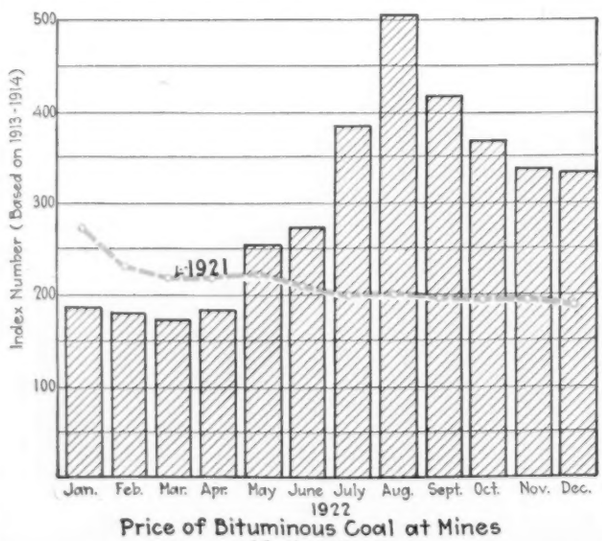
Total Average Weekly Freight-car Loadings



Construction Cost Index
(Engineering-News Record)



Lumber Production
(Yellow Pine and Douglas Fir)



Price of Bituminous Coal at Mines
(Coal Age)

A Year of Inconsistencies

THE year which has just closed has witnessed many extremely encouraging tendencies and a few extremely discouraging tendencies. The cost of construction during the first half of the year was materially under that of 1920 and 1921, but in September, prices of construction materials exhibited an upward swing which carried them above the prices of 1921 during the last quarter of the year, though they remained still many points below the prices of 1920. Actual construction, however, was far above that during 1921 with the exception of November. The rapid rise in the price of coal with the opening of the coal strike in the middle of spring applied the brakes to industrial development and the rapid return to normal. The year closed with coal prices about 90 per cent above those of 1921.